

UNITED STATES DEPARTMENT OF AGRICULTURE

Soil Survey
of
Victoria County, Texas

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By WILLIAM T. CARTER, in Charge, and C. S. SIMMONS, U. S. Department of Agriculture, and H. W. HAWKER and T. C. REITCH, Texas Agricultural Experiment Station

COUNTY SURVEYED

Victoria County is in south-central Texas, in the Gulf coast region. (Fig. 1.) Lavaca Bay, an arm of the Gulf of Mexico touches the eastern corner. The eastern boundary of the county is formed by Garcitas River, Arenoso Creek, and Guadalupe River. San Antonio River and Coleta Creek form a large part of the southern and western boundaries. Victoria, the county seat and principal city, lies in a direct line about 100 miles southeast of San Antonio and a little more than that distance southwest of Houston. The outline of the county is irregular though roughly quadrangular. The longest dimension from north to south is about 40 miles and from east to west about 30 miles. The total area is 890 square miles, or 569,600 acres.

Victoria County lies almost entirely within the Gulf coast prairie region (pl. 1, A), a broad nearly flat physiographic belt bordering the Gulf of Mexico. The extreme northwestern part of the county lies within a belt of higher rolling timbered country called the post-oak belt which is a southwest extension of the east Texas timber country. The nearly flat belt gradually increases in elevation northward and merges into the post-oak belt. Small rolling semiprairie areas of sub-humid soils, supporting a subhumid vegetation, lie in the extreme northwestern corner of the county. In the vicinity of Guadalupe River the post-oak belt is in places rolling or hilly owing to the presence of deeply cut local drainage ways. Small narrow strips of the post-oak belt lie within the coast prairie, being separated from the main timber belt. Alluvial belts, from 1 to 2 miles wide, lie along Guadalupe and San Antonio Rivers which have cut valleys from 25 to 40 feet deep.

The elevation of the county ranges from about sea level at the eastern point, which touches Lavaca Bay, to about 200 feet above sea

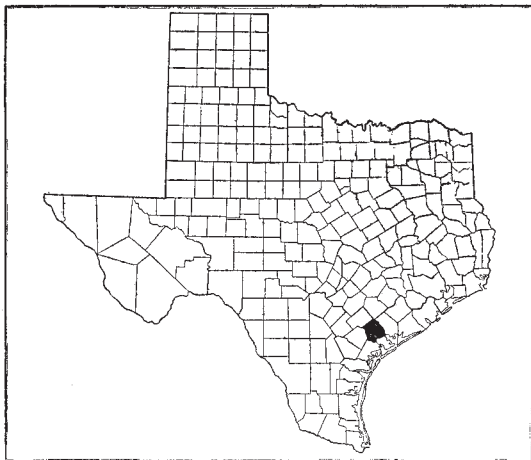


FIGURE 1.—Sketch map showing location of Victoria County, Texas

level in the extreme northern part around Fordtran and to nearly 300 feet in small areas along the county line in the northwestern part north of Mission Valley.

The supply of drinking water is adequate, and the quality is very good. Windmills pump water for most of the rural homes from wells ranging from 20 to 80 or more feet deep. Many artesian wells several hundred feet deep supply large quantities of good water to much of the southern part of the county.

Victoria County was formed in 1837 soon after Texas secured independence from Mexico. It was settled slightly more than 100 years ago by Mexican colonists who were soon followed by American settlers, some Germans, and a few Irish.

The principal industry for many years after settlement was cattle raising which is still important. Some farming was done on the river bottoms long before the Civil War. Records state that Spanish missions were established, for the purpose of civilizing the Indians, in the northwestern part of the county as early as 1714. Some of the bottom land was farmed, and vegetables and corn were grown under irrigation in the Guadalupe River bottoms. About 1686 LaSalle established a small colony of French in a place now included in Victoria County. This was the first white settlement in the region now comprising Texas, but it was only temporary.

The present population consists mainly of whites, either native Texans or from other Southern States. Many people of German, Bohemian, Irish, Mexican, and Italian descent are natives of the county. A number of people from Northern States have located in the county in the last few years. The negro population is not large. According to the census of 1930 the population of Victoria County is 20,048 of which 63 per cent is classed as rural. The rural settlement is sparse over much of the county, but is rather dense around Victoria. As a rule, settlement is thickest near the railroads. Victoria, the principal town, had 7,421 inhabitants in 1930. Guadalupe, Dacosta, Inez, Placedo, Telferner, Nursery, and McFaddin are important small railroad towns and shipping points.

Transportation facilities are good, two great railroad systems crossing the county from east to west and from north to south. The Southern Pacific lines extend from Port Lavaca on the coast through Victoria northward to San Antonio and from Houston westward through the county to Corpus Christi and lower Rio Grande Valley points. The Missouri Pacific line extends from Houston westward through the southern part of the county to Corpus Christi, Brownsville, and various other towns in the lower Rio Grande Valley, and on to Mexico City. A short line of this system extends southward from Victoria to Port O'Connor on the coast.

Guadalupe River is not navigated at present, though at one time small steamboats transported freight as far north as Victoria. The Federal Government has appropriated money to make a study of the feasibility of improving this stream for navigation in order to provide water transportation from the coast up the river some distance north of Victoria.

A good graveled road extends across the county from north to south and several graveled roads pass through some parts of the county. Most of the roads are of dirt construction, the most important ones being kept well graded and smooth, but many are impassable imme-

diately after heavy rains. Good road-building material is available in many shallow gravel beds in the northern part of the county.

All well-settled parts of the county are reached by rural mail delivery routes and telephone lines, the latter reaching most of the ranches. Good schools and churches are located throughout the well-settled communities.

Victoria is the principal local market for farm products. Houston and San Antonio markets are reached direct by railroad lines, and railroad connections extend to all large northern, western, and eastern centers. New Orleans, Houston, and Fort Worth are the principal livestock markets. Cotton is shipped mainly to Houston.

A large cottonseed-oil mill, a compress, and cotton gins are located at Victoria. Many gins are scattered throughout the farming sections in towns and community centers.

CLIMATE

Victoria County lies in the Gulf coast prairie region, where the climate is semitropical, the temperature being moderately high most of the year. The county lies near the western border of the humid region where subhumid moisture conditions exert some influence on the climate. The region is very healthful. Humidity is rather high and the altitude low. The average yearly rainfall is not high, but it is usually well distributed throughout the growing season. A very large proportion of the days are clear, and evaporation is comparatively high. The summers, though hot, are less oppressive than in higher interior locations on account of the mild invigorating Gulf breezes which blow steadily most of the time. Heat prostrations are not common.

Most of the winter season is cool and pleasant, broken by occasional northers which are often accompanied by rain, giving chilly weather for a few days at a time and occasional freezing temperatures lasting for brief periods.

The mean annual precipitation is 35.71 inches. The rainfall varies from year to year, but long dry periods are not so common as in places a little farther west. As a rule, the lightest precipitation occurs during the winter, with a monthly average of a little more than 2 inches. On account of the low evaporation at this season, together with slow natural surface drainage, the soils usually remain wetter for a longer period than at any other season. Local showers and thunderstorms provide a large part of the rain in summer. At times hailstorms damage crops over small areas. The highest seasonal rainfall is in the fall.

The average length of the frost-free season is 281 days, from February 27 to December 5. However, killing frosts have occurred as late as April 2 and as early as October 31. Many years pass with no damage to fruit by freezes, but now and then the temperature is sufficiently low to destroy unprotected citrus fruits and injure the trees. In some mild winters fruits develop so rapidly that they are damaged by late spring frosts.

The climate does not prevent the growth of citrus fruit trees though low temperatures sometimes destroy the crop. Such orchards as now exist are in small plantings so that care can be given to producing

thrifty trees, which better withstand low temperatures, and where protection can be afforded the orchard by artificial cover or heat.

Livestock require little shelter during the winter, and some grasses provide continuous grazing throughout the winter. Many vegetables can be grown during the winter.

Destructive storms seldom occur. Cotton is sometimes damaged in early fall, when it is blown from the boll, but so-called storm-proof strains of cotton are being introduced, which prevent much of this trouble. Very little crop damage is caused by soil drifting.

Table 1, compiled from records of the United States Weather Bureau station at Victoria, shows the more important climatic data for Victoria County.

TABLE 1.—Normal monthly, seasonal, and annual temperature and precipitation at Victoria, Tex.

[Elevation, 187 feet]

Month	Temperature			Precipitation		
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1917)	Total amount for the wettest year (1919)
	[°] F.	[°] F.	[°] F.	<i>Inches</i>	<i>Inches</i>	<i>Inches</i>
December	55.7	86	20	2.32	0.22	0.90
January	56.1	87	6	2.01	.57	5.00
February	56.9	93	9	2.35	.92	1.98
Winter	56.2	93	6	6.68	1.71	7.88
March	64.8	96	26	1.94	.74	2.77
April	70.7	100	36	3.36	2.27	1.30
May	76.1	99	45	4.11	1.76	7.53
Spring	70.5	100	26	9.41	4.77	11.60
June	82.0	103	51	3.15	.00	8.19
July	84.0	108	60	3.33	1.47	11.40
August	84.5	105	61	3.05	.34	2.88
Summer	83.5	108	51	9.53	1.81	22.47
September	80.3	106	46	3.66	1.63	5.61
October	72.5	98	32	3.63	.00	10.61
November	64.0	93	18	2.80	1.23	1.40
Fall	72.3	106	18	10.09	2.86	17.62
Year	70.6	108	6	35.71	11.15	59.57

AGRICULTURE

Since the days of early Mexican colonization of the region more than 100 years ago, livestock raising has been a very important industry.

Early settlers, both Mexican and American, utilized the free range without other feed in a loose system of cattle ranching. For many years practically the only industry was cattle and horse raising, and only a small acreage of land was cultivated for the production of very small quantities of vegetables and corn as sustenance crops.

Some farming was done on the river-bottom lands with slave labor before Texas became independent, about 1836. Corn was an important crop, being produced for sale as feed for freighting teams and for shipment into other settlements of Texas. Coast ports located

just south of Victoria were shipping points and much of the freight traffic passed through Victoria to San Antonio and other places.

Prior to the Civil War considerable cotton was raised and ginned within the county. During the Civil War cotton was hauled to Brownsville and shipped from Mexican ports.

With increased settlement, large tracts of land were bought up by cattlemen and fenced into individual units by the owners. In the early days, cattle markets were distant and reached with difficulty. This caused a very low price, but no feeding was necessary, and the cost of raising cattle was very low. At that time cattle were marketed in New Orleans and other places, by steamship transportation from near-by coast ports. A few small local packing plants used some of the cattle carcasses for tallow and the hides, which were marketed, and the meat was discarded.

The impression prevailed here, as it did in the early period of settlement of all prairie regions, that prairie soils were unsuitable for cultivated crops, and the imperfect drainage and heavy subsoils in the prairies of Victoria County tended to confirm this general opinion. Within the last few years these soil conditions have received considerable attention. The slow natural drainage over about 49,000 acres of the flat prairie lands of Victoria County has been facilitated, with excellent results, by deepening and straightening the drainage ways and extending ditches from the drainage ways into large bodies of poorly drained lands.

At various times during the last 20 or 30 years, ranch lands have been subdivided and sold to farmers. About 1905 a decided farming impetus began but was checked by economic conditions following the World War.

Important factors encouraging the development of farms on the prairies have been the entrance of railroads, introduction of barbed-wire fencing, and installation of drainage systems.

Land is still held in large holdings so that the existing forms of land utilization include the raising of farm crops, cattle ranching, and combined ranching and crop production. About one-third, or a little more, of all the land in the county is utilized for cattle raising on large ranches, and an equal amount is utilized for general farming and cattle ranching combined. A few livestock ranches including 30,000 or more acres remain. All ranches are well fenced, and they are scattered through various parts of the county. The ranches still in existence are not confined to any particular soil, but the greatest increase in farms has taken place on the dark-colored soils and along the railroads.

Cattle are grazed the year round, the open range comprising a thick heavy growth of nutritious grasses which carry a large number of cattle throughout the year. The better-drained light-colored soils of the coast prairie produce the heaviest growth of range forage which consists largely of broom sedge (*Andropogon* sp.), paspalum, and many other grasses. The grasses growing on the dark-colored soils of the coast prairie consist of some species of broom sedge and paspalum, mixed in places with grama, mesquite, and buffalo grasses. The range value of the grasses on the dark-colored soils is said to be better than that on the light-colored soils. On the ranches composed mainly of dark soils about 8 acres to the cow is allowed for breeding animals. This amount provides also whatever grazing is necessary

for the calves up to the time they are marketed at the age of about 8 or 10 months. The land is said to be better suited for the production of fat calves for market than the light-colored soils. On the light-colored soils, the ranches are utilized less for pasturing breeding animals and calves, and more extensively for steers which are grazed until they are 2 or 3 years old and are then sold for slaughter or sent to ranges in other parts of the State or other States for further grazing or grass fattening. About 5 acres of pasture carries a steer on the light-colored soils.

On account of the mild climate, shelter for range cattle is not provided, though such natural cover as belts or clumps of trees afford shelter in the few short periods of cold weather. Damaging droughts seldom injure the range grasses. The mild climate appears to favor parasites and cattle diseases, but these have been largely eradicated by treatment and by increasing, through scientific breeding, the natural resistance of the animals. On the whole, the business of ranching in Victoria County is carried on by the most progressive and up-to-date methods and has long been the most certain and profitable industry.

The Brahman breed is an important type of cattle in the county, some of the earliest importations having taken place many years ago. These cattle have been crossbred with native animals and with Shorthorn and Hereford cattle, and a resultant strain that appears to be resistant to insects and diseases has been established. The resistance to insects and diseases as well as adaption to range conditions has made the Brahman cattle very valuable to the ranchmen of the county. Small numbers of purebred and high-grade Hereford and Shorthorn cattle are raised. Purebred bulls are found on most ranches.

Range cattle are rarely fed. A few cattle are fattened on cottonseed meal and hulls, and occasionally some locally grown grain or forage is added.

Practically all the beef animals shipped for slaughter are calves from 6 to 10 months old. The calves are allowed to run with the cows up to the time of shipment, when most of them are fat enough for slaughter without extra feeding. Calves are marketed in New Orleans or shipped to packing houses in Fort Worth and Houston.

Stockers, some raised in the county, others brought from outside, are usually grazed a year or two, then shipped to ranges in Oklahoma and Kansas for pasture fattening, or sold directly for slaughter.

According to the census of 1920 there were in Victoria County, 51,898 beef cattle valued at \$2,313,259. It is estimated by local authorities that 40 per cent of this number was raised on the ranches and the remainder on farms.

The loin disease of cattle appears to be rather common in the coastal prairie country, and in this county it is noted that this disease occurs mainly in cattle raised on soils having an acid reaction, that is, the Hockley, Edna, and Katy soils.¹

The most extensively farmed lands of the county are the bottom lands along Guadalupe River in the northwestern half of its course through the county, and the dark-colored soils. General farm crops are produced.

The prevailing systems of farming consist mainly of two classes,

¹SCHMIDT, H. FIELD AND LABORATORY NOTES ON A FATAL DISEASE OF CATTLE OCCURRING ON THE COASTAL PLAIN OF TEXAS (LOIN DISEASE). Tex. Agr. Expt. Sta. Bul. 319, 32 p., illus. 1924

small farms operated by owners or by share tenants and large plantations operated by owners or managers through share tenants or croppers. Cotton is grown as a cash crop, and corn, sorgo, and grain sorghums, together with small amounts of Sudan grass and other forage crops, for feed crops. The proportion of land devoted to cotton on the large plantations is somewhat higher than on the small farms. Only very small amounts of orchard fruits, vegetables, and berries are grown, these products being produced mainly for home use and local sale.

Cotton occupies about two-thirds of the land devoted to crops. Corn, which ranks next in importance, probably occupies about half as great an acreage as cotton.

According to the census of 1880, there were 1,739 acres in cotton in 1879, producing 730 bales; 6,253 acres in corn, yielding 90,210 bushels; 59 acres in sugarcane, yielding 8,991 gallons of sirup; and only a very slight acreage in a few other crops.

By 1889, the land devoted to cotton had increased to 7,904 acres and the production to 3,735 bales. The 9,891 acres in corn produced 202,505 bushels.

Ten years later, the census showed considerable increase in land devoted to farm crops. Cotton was planted on 19,424 acres with a return of 9,459 bales; corn on 23,444 acres, yielding 490,080 bushels; coarse forage on 2,973 acres, producing 5,436 tons; and wild grasses cut for hay on 3,480 acres, yielding 3,304 tons. The same year animals sold and slaughtered gave a return of \$403,807; poultry raised, \$22,664; and dairy products (excluding home use) were valued at \$7,661.

In 1909 cotton was grown on 31,767 acres, yielding 10,071 bales; corn on 22,313 acres, producing 463,358 bushels; and hay cut from 6,054 acres of wild grasses produced 5,918 tons. Alfalfa was grown on 279 acres with a yield of 1,166 tons of hay. Sugarcane was grown on 392 acres with a total yield of 118,194 gallons of sirup. The census also reports 2,319 fig trees producing 3,056 pounds of fruit in that year. Cattle, including calves, sold and slaughtered that year numbered 16,378 head, and swine, 4,821 head. The total value of animals sold and slaughtered amounted to \$408,033; the value of dairy products (excluding home use) was \$46,121; of poultry and eggs, \$67,220; vegetables, \$38,784; hay and forage, \$68,325; fruits and nuts, \$4,450; cereals, \$272,452; and of all other crops, more than \$815,775. The total value of all agricultural products in that year was \$1,724,725.

The 1919 figures showed the cotton acreage about double that in 1909, being 61,661 acres, and the yield was 7,301 bales. Corn grown on 24,477 acres produced 455,520 bushels, and 2,216 acres of coarse forage yielded 5,009 tons. Figs from 851 trees yielded 7,496 pounds of fruit. There was a total of 51,898 beef cattle in the county valued at \$2,313,259; the 7,704 head of dairy cattle were valued at \$305,195; the 3,424 sheep, at \$25,151; the 8,988 swine, at \$104,394; and chickens and other poultry, at \$67,727.

The total value of all agricultural products for the year 1919 was \$6,421,290. Of this amount the cereals produced were valued at \$621,938; other grains and seeds, at \$5,423; hay and forage, at \$210,062; vegetables, at \$104,192; fruits and nuts, at \$11,623; and all other crops (mainly cotton) at \$1,415,616. The value of all

domestic animals in the county at that time was \$3,774,775; of dairy products, \$109,116; and of poultry and eggs, \$164,760.

Irregularities in acreage and crop yields have been owing mainly to climatic conditions and insect pests.

The figures given show that cotton occupies about two-thirds of the total acreage devoted to crops. The acre yield varies considerably with seasonal conditions, insect infestations, and plant diseases. The average seems to be between one-third and one-half bale to the acre, though many of the soils are capable of producing, and frequently do produce, as high as 1 bale. The varieties generally grown are Mebane, Kasch, Bennett, and Lone Star. The last-named is said to be especially favored on account of its storm-proof qualities, the cotton not blowing out of the boll so readily as with the other varieties. Its staple is said to be somewhat better and longer also. Local authorities state that the Lone Star does not make as satisfactory growth or produce as well on the sandy soils as on the heavy black lands. It is estimated that half the cotton planted in the county is Lone Star and the proportion is being gradually increased. A number of insect pests including the flea hopper, boll weevil, bollworm, leaf worm, and woolly worm or salt caterpillar, do great damage to the cotton crop at times. The boll weevil appears worst on the alluvial soils where the cotton plant has a tendency to make a very rank growth.

The soils of the Lake Charles, Trinity, Catalpa, and Guadalupe series appear to produce the highest yields of cotton, though the crop is grown successfully on nearly all soils of the county. In some years considerable infestation of cotton root rot causes a great loss. This disease is worst on the heavy dark upland soils, especially the Lake Charles soils. It appears to give less trouble on the bottom-land soils, and gives little or no trouble on the upland soils having an acid reaction, mainly soils of the Edna and Hockley series. Studies of this great menace to cotton production is being made by the Texas Agricultural Experiment Station.²

It appears that the damage done by this disease may be largely minimized by clean cultivation, crop rotation, and by keeping the soil clear of any winter growth.

The quality of the cotton staple grown is good, ordinarily averaging $1\frac{1}{8}$ inches in length, the longer staple being grown as a rule on the dark-colored soils. It is said that a premium is paid for the cotton produced on the stronger soils of the county on account of the excellent staple, and that much of the cotton produced here is shipped to Liverpool.

Cotton planting is ordinarily begun early in March and continues to the middle of April, though it may be planted as late as the first of June but with less chance of obtaining a good yield. Some cotton is ready for picking the first of August. Census figures for the 1924 crop show that 68,197 acres were planted, yielding 20,782 bales.

Corn is used principally for feeding farm animals and for local sale, though in some years a small amount is shipped from the county; in other years the amount grown may be insufficient for local requirements. As a rule, corn seems to be a very successful crop as the

² TAUBENHAUS, J. J., and KILLOUGH, D. T. TEXAS ROOTROT OF COTTON AND METHODS OF ITS CONTROL. Tex. Agr. Expt. Sta. Bul. 307, 98 p., illus. 1923.

rainfall of the region is usually sufficient to mature a good crop. The bottom-land soils appear best suited for corn, the Trinity, Catalpa, and Guadalupe soils producing the highest yields which often approximate 60 bushels to the acre. The dark prairie soils of the Lake Charles series rank next as corn soils, the yields averaging between 30 and 40 bushels. On the light-colored sandy soils yields range from 15 to 25 bushels to the acre, sometimes higher. The favorite varieties grown are Reid Yellow Dent and Surcropper, which appear best suited to local conditions. The Tuxpan variety of corn is favored by some farmers. Considerable care is used by farmers in selecting seed to produce strains having long husks which deter weevil infestation. This selection has resulted in producing strains having desirable qualities which conform largely to local environment. Corn planting takes place from the latter part of February to the first week in March. The census figures show that 351,783 bushels of corn were produced in the county in 1924.

Much of the grain-sorghum crop is cut and bundled, without separate harvesting of the grain, and fed to the work animals. Yields of grain range from 30 to 40 bushels to the acre, and when cut for dry forage 1 or 2 tons are obtained. Grain sorghums are planted early in March and harvested early in July. A second crop, which produces about half as much as the first crop, is obtained in November. Some damage is done by the midge, especially to the second crop, and birds often cause a considerable loss. Apparently the production of grain sorghum will continue to increase in the county.

Sorgo is either broadcast or sown in rows for both hay and coarse forage. It frequently produces two crops in one year and total yields of 4 or 5 tons of forage to the acre are often obtained. Dates of planting and harvesting are about the same as for the grain sorghums. The Red Top, or Sumac, variety is most commonly grown. Sorgo is favored by farmers on account of the considerable length of time it may stand without damage after being ready for harvest. Some Sudan grass is grown, which makes good pasturage and yields, in two cuttings a season, around 3 tons of hay to the acre. Millet has been grown successfully by a few farmers, and it yields from 1 to 2 tons of hay to the acre.

Sugarcane is grown very little at present, though large plantings have been grown at times on the river-bottom soils by a few farmers. Yields were very good, about 300 gallons of high quality sirup to the acre being produced. Owing to overflows, insect pests, and various economic reasons, production on a large scale has been discontinued.

At various times rice has been grown on the dark-colored prairie soils in the southern part of the county. Several large areas of land were developed for this crop with the necessary expensive plants for pumping and distributing irrigation water from Guadalupe River, from Placedo Creek, and from wells, but the crop is not now grown, the cost of production, according to local information, being too great. In parts of the Gulf coast prairie east of Victoria County the most successful production of rice is on practically the same soils as some that occur in Victoria County.

In places, especially on the heavy virgin soils of the county, some native prairie grasses are mowed for hay. One good crop and fre-

quently two are obtained, yielding 1 or more tons to the acre at each cutting. The grasses cut are mainly coarse bunch grasses. Angleton grass, developed by the Texas Agricultural Experiment Station in cooperation with the United States Department of Agriculture, is a valuable high-yielding grass for hay or pasturage and is well suited to the coast prairie region. Probably it could be introduced into Victoria County with profit.

Alfalfa has been grown in small fields by a few farmers. The crop makes an excellent growth on the calcareous soils of the river bottoms where drainage is good. Yields of around 1 ton to the acre are obtained at each mowing and the crop may be cut four or five times in one season. Some difficulty is experienced in procuring a bright-colored hay, owing to the damp atmosphere prevailing through the night. The Trinity, Catalpa, and Guadalupe soils are especially suited to alfalfa.

Some sweetclover is grown on the alluvial river-bottom soils for pasturage and for hay, and excellent yields are obtained from several cuttings a year. Bur clover grows wild along the roads and in many pastures, especially on the Lake Charles and bottom-land soils. It makes good grazing for livestock and appears to be gradually spreading over some of the dark soils. Subterranean clover is also suited to conditions in this county and might be introduced with success.

Vegetables are not grown commercially except for the small local markets. The well-drained soils are all well suited to the production of vegetables, and many kinds may be grown. The sandy soils with clay subsoils, such as the Goliad, Lake Charles, and Hockley soils, are especially well suited to vegetables, berries, melons, potatoes, and similar crops. The long growing season and mild temperatures prevailing in winter especially favor the production of vegetables.

No large plantings of orchard fruits are to be found, but small plantings of peach, plum, and pear trees may be seen around most homesteads. As a rule fair yields of fruit are obtained. Considerable effort is required to combat the San Jose scale, which is said to be very destructive, and late frosts sometimes kill the fruit buds.

Fig trees make a good growth especially on the better-drained areas of the Lake Charles, Hockley, and other well-drained soils. The trees seem to be more healthy and vigorous on the heavy, dark-colored soils. The Magnolia fig does well.

A few citrus trees may be seen in the home gardens where they grow vigorously and produce good yields of fruit. A few orchards of Satsuma oranges are making a good growth. Occasional freezes kill the buds and damage the trees where not protected. One commercial orchard of several acres on Hockley and Edna fine sandy loams near Telferner is reported by the owner to have given profitable returns for several years, with the exception of one or two years when the crop was damaged by freezes. The Satsuma orange on trifoliolate stock appears to do better than any other citrus fruit in Victoria County. It is said that the Dagaut and several varieties of navel oranges grow well. Grapefruit and lemon trees are said to grow and bear well, but plantings comprise only a few trees which are grown around the houses. According to local information, the trees do not grow well on

alluvial soils, but they thrive on most of the upland soils. In a small nursery in the county about 20 Texas varieties of citrus fruit trees are growing well.

All kinds of berries do well but are grown only in small patches for home use and local sale. The heavy Lake Charles soils are best suited to blackberries, dewberries, and raspberries, and the Hockley, Lake Charles, Goliad, and DeWitt fine sandy loams as well as some other soils are well suited to strawberries. Strawberry plants are set out in October and begin to bear in March. The Klondike is the most widely grown variety.

Grapes make a good growth on most soils, and many good vines appear in the home gardens, but this fruit is not grown on a commercial scale. The wild mustang grape grows extensively, and improved varieties grafted on seedlings of this grape do exceedingly well. The best-improved varieties for the county are Carman, Munson, Niagara, and Edna.

Native pecan trees grow well and produce good yields of nuts on the better-drained soils of the Trinity, Catalpa, and Guadalupe series, especially the latter. From the vigorous growth of the trees and excellent quality of the nuts it would seem that along San Antonio and Guadalupe Rivers the pecan has found its most ideal habitat. Many of the native pecans are of papershelled and soft-shelled varieties. Some of the nuts are large, weighing at the rate of 42 to 45 nuts to the pound and average as high as 52 per cent nut kernel. Many pecan trees are left when the land is cleared for cultivation, and crops are grown within the pecan orchards in places. Many large trees are found throughout cultivated fields. Considerable attention is being given to the conservation and improvement of pecans, much improved stock being budded on native trees. Many native trees produce nuts that have naturally developed into varieties equal to many of the best-improved varieties developed elsewhere. Many trees are planted on the uplands as shade trees around homes and these generally do well, though growth is not so rapid as on alluvial soils. It is reported that \$100,000 worth of pecans were sold, both in 1924 and 1926, from trees growing in the county. There seems to be an excellent opportunity for the development of a pecan-growing industry in Victoria County as, according to local information, the trees often bear here when there is a failure in other parts of the State.

A few silos are seen in various parts of the county, but their use has not become common. Fairly good results have been obtained in feeding silage to beef and milk cattle. Many small flocks of sheep are kept, and these do well on the better-drained lands but are subject to diseases and parasites on the poorly drained lands. A few hogs are raised on most farms. Hog raising can be carried on successfully, and a much larger number could be utilized by local markets.

Poultry is raised on many farms and is sold to local buyers for shipment. Though much of the poultry is not purebred, there are many flocks of purebred fowls. Turkeys are raised very successfully, especially in the post-oak belt which seems especially suited to this fowl. Considerable attention is being given to turkey raising, and the sale of turkeys adds several hundred dollars annually to the income of many farmers. Post-oak trees furnish a good yield of acorns which, farmers say, constitute good feed for turkeys.

Dairying is practiced around Victoria to supply milk and cream to the local trade. Much butter and milk is produced on many farms for home use, and some is sold locally. Many farmers own good milk-producing cows, some of which are purebred or good grades, mainly of the Jersey breed. Recently cream routes have been established and many farmers are finding an outside market for their dairy products. The cream is shipped to various creameries in cities outside the county. The recent development of the cream-shipping industry is causing many farmers to purchase purebred cattle. In this region, where an abundance of feed and forage crops is easily grown, it would seem that an extension of the dairy industry would be profitable.

In natural productivity the soils of the county may be arranged in the following order: (1) Alluvial soils; (2) dark-colored prairie soils; (3) light-colored well-drained prairie soils; and (4) light-colored timbered soils. This classification is based on natural soil characteristics, other soil-forming influences, such as surface relief and drainage, being similar.

Some farmers have made tests of commercial fertilizers on a number of the soils, and reports vary as to results. In some years crop yields have seemed to increase somewhat, whereas at other times little advantage has been noted. Fertilizers appear to return little profit on the alluvial soils, though on some members of the Guadalupe series which have been under cultivation for a long time increased yields might be obtained. It seems to be the consensus of opinion that little advantage has been obtained in this county from using commercial fertilizers for the general farm crops on the dark-colored or Lake Charles soils. On the Hockley and Edna sandy soils some farmers have noted increased yields and some have not. Possible reasons for lack of response have been attributed to too much rain or too little soil moisture in the early spring. Barnyard manure has been used by some farmers with very good results on the sandy soils, but such practice is not general. The incorporation of organic matter also tends to ameliorate the tight packing tendency of such soils as the Edna. Most of the light-colored sandy soils of the county are acid in reaction, indicating a sour condition. Liming would probably neutralize this condition and possibly increase the production of some crops. Possibly the use of marl, which lies beneath the surface soil in many parts of the county, would be advantageous in neutralizing soil acidity as it contains a large amount of lime carbonate. Tests are being made with this material by some farmers.

Through long experience many farmers of the county have learned much concerning the adaptation of their soils to different crops. Cotton can be grown successfully on practically all the soils, and, being the most certain cash crop known for the region, is that most extensively grown. The market for corn is uncertain, and yields are not sufficiently high on many soils to make this a profitable cash crop. The same may be said of the grain sorghums and other forage crops. Small grains are not well suited to the region. Therefore cotton growing and livestock farming appear the most certain industries, though insect infestation, cotton root rot, and low prices make returns from cotton growing rather unprofitable in some years. Truck farming and dairying promise to become important aids in the future development of agriculture in Victoria County.

The farmers recognize that the Trinity, Catalpa, and Guadalupe soils are best suited for cotton, coarse forage crops, corn, alfalfa, and the clovers, as well as for pecans. They realize that the Lake Charles soils are best suited for cotton and corn, grain sorghums, and forage crops; that the Hockley fine sandy loam is a good soil for vegetables, orchard fruits, melons, berries, and grapes, and with care fair yields of the general farm crops may be obtained; and that the Edna soils are thin soils which need better drainage for even moderate yields of the same crops as are grown on Hockley fine sandy loam.

No regular system of crop rotation is in use, although many farmers make a practice of changing the land every year or two from cotton to corn and corn to cotton. However, some plant cotton for many successive years on the same land. This does not seem to materially affect the strong alluvial soils, but it is known to cause deterioration in productiveness of the upland soils.

Natural drainage is very slow over much of the county. Although sufficiently drained to produce crops in most years, the bottom-land soils are occasionally overflowed, causing some loss if the overflows occur during the growing season. A number of low levees have been constructed by some landowners. Some of these are effective, but many have been partly destroyed by unusual floods and have not been rebuilt. In many places on the flat prairies drainage is so deficient that water stands on the surface or keeps the soil completely saturated for months at a time. Drainage districts have been formed in sections around Salem, Bloomington, Placedo, and Guadalupe, comprising areas aggregating 49,000 acres of land, and drainage has been greatly improved by a system of ditching, which, according to local information, has cost about \$150,000 for the four areas.

The land is prepared in much the same manner for all crops. It is usually bedded in late fall or winter, the bed lying just over the middle between the rows of the previous crop. The land is sometimes rebudded in order to break up the soil of the middles but usually the seed is planted on the original bed leaving the land nearly level. Some farmers flat break the land and then bed it, but this is not common custom. The crops are cultivated several times, usually just after rains. Cotton is attended closely and the crop kept well cultivated and free of grass and weeds. After laying by the corn or other grain crops, weeds and grass come up during the summer and make a heavy growth in many fields. At planting time the soil is often of a fine clod or small clod structure and it has proved advantageous to run heavy rollers over the freshly planted seed bed in order to press the soil closely about the seed thus insuring germination and growth.

Most of the farm machinery and implements are of improved types. Many farmers use tractors on the heavy dark soils. The work animals include medium-sized horses and mules. Some farmers raise their own work animals and have a small surplus for local sale. As a rule farm homes and barns are small, though many good-sized buildings with modern improvements are to be seen.

The supply of farm labor is generally abundant though at times, in the busiest seasons of cotton chopping or picking, it is scarce. Most of the hired farm labor is Mexican or negro. On the larger farms, homes are furnished the laborer's family and he is paid from \$1 to \$1.50 a day for an average of 5 days a week throughout the year.

Little farm labor is hired by the month. Cotton pickers are often brought in from outside the county. The amount paid for picking ranges from about 75 cents to \$1.50 a hundred pounds of seed cotton.

According to the census of 1920, 60.7 per cent of the farms were operated by tenants, 38.3 per cent by owners, and 1 per cent by managers. Farms are ordinarily leased on shares, the owner receiving one-fourth of the cotton and one-third of the grain and forage crops. Some owners lease on the half-share system, in which the owner furnishes work animals, implements, and seed, in addition to the house.

The selling price of farm and ranch lands is said to be somewhat lower now than it was a few years ago. Not a great deal of land is changing hands. The selling price of the well-drained higher-lying improved alluvial soils ranges from about \$50 to \$100 an acre. On the smooth dark soils the prices range from about \$40 to \$125, depending on improvements, drainage, and location. The upland sandy soils bring from around \$15 to \$50 according to location, drainage, and improvements.

NATURAL VEGETATION³

The virgin soils of Victoria County are covered with a heavy growth of natural vegetation, including a large number of species of grasses, herbaceous plants, shrubs, and trees, each type of plant community characterizing groups of soils which have definite related characteristics. The natural vegetation is also related to various geographic features such as soils, topography, drainage, and climate.

Two broad groups of vegetation types are found in the county. These are: Trees with associated shrubs and grasses with herbaceous plants. The tree communities lie broadly in two main divisions, each found on particular groups of soils, the upland tree growth and the alluvial-soil tree growth. The upland tree growth, mainly oak (*Quercus*), is represented by several species, principally post oak, live oak, and blackjack oak. The post oak and blackjack oak have a very small amount of hickory associated with them. The post oak-blackjack oak community occupies a broad belt of country which covers or enters a large number of eastern Texas counties. It extends from Red River in a southwesterly direction passing mainly just north of Victoria County but including considerable areas in the northwestern part.

Spurs of the post-oak belt extend southward into the coast prairie as narrow bordering belts of timbered uplands adjacent to the alluvial timber belts. They are separated here and there from the main belt by prairie lands. As the character of the timber growth changes toward the west, where climatic conditions approach the subhumid type, the post oaks thin out considerably, especially on approaching the prairies, and present a parklike open growth of large trees, with very little undergrowth or shrubs. The post oaks constitute the main timber growth of the belt and are the characteristic growth on soils of the DeWitt and Susquehanna series. The largest number of blackjack oaks occur on the gravelly and deep sandy soil areas of these soils and on Norfolk fine sand.

³ Grasses and herbaceous plants were identified and scientific names given by the office of botany, Bureau of Plant Industry, U. S. Department of Agriculture.

The line of demarcation between the post-oak belt and the coast-prairie belt is not sharp. There is a gradual thinning of the trees toward the prairie with here and there outlying clumps, live oaks in most places forming the advance guard of tree growth. The encroachment of the timber is mainly onto the better-drained areas of soils. Within the tree belt a thinning of the trees in flat poorly drained areas is noticeable, some small spots having a distinct prairie appearance. It would seem therefore that the absence of timber growth on the prairie land is owing, in part at least, to poor drainage. This seems especially true, considering that the mature soils of the adjacent higher coast prairie are very similar to those of the post-oak belt.

Narrow belts of post oaks and live oaks, separated from the main belt, border the Garcitas River and Arenosa Creek bottoms for miles, occupying narrow strips of land between the bottoms and the prairie. Small sequestered clumps of these trees occur near the stream valleys in a few places on the prairies. At the margins of the prairies large areas of scrubby live oaks grow very thickly over the land. The large live-oak trees occur chiefly outside of the main post-oak belt and appear to prefer the sandy members of the Norfolk, Goliad, and Bienville series, though some are found elsewhere. On some of the deep sandy soils many open parks or groves of magnificent very large live oaks grow. Some of the trees are from 15 to 20 feet in circumference at the base and are perhaps hundreds of years old.

Associated with the oak growth in many places are various shrubs, among which an evergreen, the yaupon (*Ilex vomitoria*), is abundant. Greenbrier, wild grape (mustang), poison-ivy, and many other shrubs and vines are present in many places. The accompanying grass cover is very thin and comprises andropogons and several species of coarse grasses. Judging the character of the soils from the tree growth as an indicator it would seem that the presence of post-oak trees represents soils having fair surface drainage but, on account of their dense subsoils, slow interior drainage. The blackjack oak seems to find its best development on thin porous soils of high gravel or sand content. The live oak seems to prefer well-drained soils which vary widely in texture and structure, but the best specimens grow on deep, loose, sandy soils and have no particular association with other trees.

The alluvial-soil division of tree growth includes characteristic species occupying the deeply intrenched stream valleys. These tree species occur in varying proportions according to the soil and drainage conditions. The relationships of genera and species to such factors are fairly well indicated by their development in the bottom lands. These trees are all festooned with a heavy growth of a long tree parasite, Spanish-moss. In general, the bottom-land timber consists of a thick growth of elm, ash, hackberry, and pecan, with smaller numbers of gum elastic (*Bumelia lanuginosa*), buckeye, bur oak, live oak, white oak, anaqua (*Ehretia elliptica*), willow, cottonwood, sycamore, prickly-ash, and cypress. The undergrowth consists of shrubs, vines, and small trees, such as wild grape, haw, rattan, briers, and many other species.

The proportion of the different plant species varies greatly, according to natural drainage. The elevation of the bottom lands ranges from about 100 feet above sea level in the northern part of the county to almost sea level in the southern part. There is a general change

in species with lower elevation, owing to the consequent poor drainage and high water table in the lower places. In those places where the bottom lands are less than 25 feet above sea level, tree-free areas begin to occur forming bottom-land prairies in the lowest parts or depressed basinlike areas which as a rule do not lie near the streams. These prairies are covered with coarse grasses, spots of marsh grass, and large weeds, such as the very thick-growing wolfweed (*Aster spinosus*).

Toward the the coast the trees finally disappear where elevations of less than 15 feet above sea level occur, and the salt marsh-fresh-water marsh mixed type of vegetation prevails. In most of the areas transitional between bottom-land prairie and marsh, elm, ash, and hackberry trees predominate.

Few species that seem to find their natural habitat in the stream bottoms occur on the uplands, though some live oak, anaqua, gum elastic, and prickly ash occur outside the bottoms. The oaks that grow in the bottom are principally bur oak, white oak, and live oak. These species are very scarce, and are found mainly in the better-drained soils of the Catalpa and Guadalupe series.

Pecan trees seem to find their ideal development on the better-drained alluvial soils that are rich in lime carbonate. The trees seem to require well-drained positions and few are found below an altitude of 20 feet, or on soils lying at higher altitudes but with such poor drainage that water stands for a considerable period of time. As the pecan does best on calcareous soils with a crumbly structure, affording thorough aeration throughout the soil, the Guadalupe soils seem the most suitable for this tree. The pecan tree does best where it has a great deal of soil moisture but does not thrive if water is so abundant as to exclude air from the soil mass for considerable periods. Therefore, most of the pecan trees are found on higher-lying areas in the bottoms and on stream banks. The pecan trees grow naturally on well-drained areas of the Trinity and Catalpa soils.

Other trees which seem to thrive on soils favored by the pecan are the bur oak, white oak, anaqua, buckeye, and cottonwood. In this region it would seem that these trees are fair indicators of bottom-land soils suited for pecan trees.

The poorly drained soils of the bottoms are occupied mainly by ash, elm, and hackberry trees. This association predominates over large flat or basinlike bottom-land areas of Trinity and Catalpa soils. This growth does not indicate a wet condition the year round but only for long periods at certain seasons.

Here and there small spots of very wet land at the margins of small lakes and sloughs support the few cypress trees in the county.

The coast prairie, comprising by far the greater part of the county, is covered with a heavy growth of coarse bunch grasses, together with some of the short grasses. The coarse grasses seem to be indicative of the humid-climate type of vegetation as these species are common throughout the Gulf coast prairie east of Victoria County. The short-grass type of vegetation occurs mainly in the western part of the county indicating subhumid climatic influences. Toward the west it is noted that the coarse-grass vegetation soon gives way almost entirely to the short-grass vegetation of mature soils. On the Lake Charles soils in the southern part of the county, the short-grass vegetation is found in places as far as the east border of the county, and

some has been seen on the calcareous humps or hog wallows in Lake Charles clay 100 miles east of Victoria County.

Climatic differences influencing vegetation are also indicated by the almost complete absence of mesquite trees in the eastern part of the county, and by a rather abundant growth of mesquite in sections of the western part. A few scattered specimens of huisache (*Acacia farnesiana*), a beautiful small evergreen tree, and clumps growing on flat areas over the coast prairie reach far east of Victoria County, being very abundant in some places, especially on the Lake Charles soils. This tree apparently withstands excessive moisture conditions and takes the place of mesquite in the humid part of the coast prairie.

The grass vegetation of the county may be grouped broadly into the coarse bunch-grass association of plants, which occupies the greater part of the county, and the short-grass association which occupies small areas in the western part. The coarse-grass association may be further divided into the *Andropogon-Paspalum* and the *Andropogon Bouteloua* communities of grasses.

The *Andropogon-Paspalum* community covers the better-drained areas of the belt of light-colored soils (Hockley and Katy fine sandy loam soils) and includes many species of grasses, chief of which are *Andropogon scoparius*, *Paspalum plicatulum*, *Panicum sphærocarpon*, *P. helleri*, *Sporobolus berterianus*, *Elyonurus tripsacoides*, *Festuca octoflora*, and *Phalaris caroliniana*. Associated herbaceous plants, which occur in abundance in this association, are *Vicia texana*, *Phlox drummondii*, *Callirrhoe involucrata*, *Trifolium bejariense*, *Plantago virginica*, *P. aristata*, *Coreopsis nuceensis*, *Geranium texanum*, *Monarda lasiodonta*, and others. A characteristic association of large weed-shrubs are *Stillingia sylvatica* and a partridge pea (*Chamaecrista fasciculata*).

Associated with many of these plants on the more poorly drained parts of the light-colored soil belt (Edna fine sandy loam) is a growth of the following plant species: *Chloris nashii*, *Manisuris cylindrica*, *Juncus tenuis*, *Paspalum plicatulum*, *Stipa leucotricha*, *Cyperus ovularis*, *Eragrostis beyrichii*, and such herbaceous plants as *Verbena halie*, *Neptunia lutea*, *Rudbeckia bicolor*, *Sabatia campestris*, *Sida ciliaris*, and others.

Small spots of very poorly drained areas in the belt of light-colored soils are occupied by considerable variations of the *Andropogon-Paspalum* community, or possibly a different community including some of the species mentioned. These occur on Edna fine sandy loam, shallow phase, and on Edna fine sandy clay loam and include some very coarse water-loving grasses and much of the senna-bean (*Daubentonnia longifolia*). The principal grasses, in addition to some already mentioned, are *Cyperus pseudovegetus*, *Panicum hians*, *Juncus aristulatus*, *J. sciroides*, *Chaetochloa geniculata*, and the herbaceous plants are *Sagittaria lancifolia* and others.

The *Andropogon-Bouteloua* community dominates the vegetative growth of the belt of dark soils of the coast prairie and includes mainly the soils of the Lake Charles series, the heavy types of which, the clay and clay loam, show the best plant community development. The grasses are as follows: *Andropogon saccharoides*, *Bouteloua texana*, which prefers spots of soil containing lime carbonate, as on humps of hog wallows, *Phalaris caroliniana*, *Stipa leucotricha*, *Fimbristylis castanea*, *Agrostis hiemalis*, *Eragrostis secundiflora*, *Paspalum plicatulum*, and in cultivated fields as pests, *Panicum fasciculatum* *chartaginense*

and *Brachiaria platyphylla*. Characteristic associated herbaceous plants are *Monarda dispersa*, *Plantago virginica longifolia*, *Sabatia campestris*, *Senecio glabellus*, *Baptisia bracteata*, *Hartmannia speciosa*, *Polygala alba*, *Callirrhoe lineariloba*, *Nemastylis coelestina*, and various others. A very characteristic weed of the heavy dark soils is broom-weed (*Gutierrezia dracunculoides*). The sandy soils of this belt, the Lake Charles and Goliad fine sandy loams, support some of the species mentioned and also such species of grasses as *Elyonurus tripsacoides*, *Cenchrus pauciflorus*, *Bouteloua hirsuta*, and *Sporobolus berterianus*. In many places, especially on the calcareous spots or hog-wallow humps of Lake Charles clay, a considerable growth of buffalo grass (*Bulbilis dactyloides*) occurs.

A community of salt weeds and coarse grasses occurs on the narrow fringe of semimarshy lands adjacent to the coast. Prominent species are of the following genera: *Atriplex*, *Monanthocloe*, *Salicornia*, *Distichlis*, *Batis*, and *Spartina*. These are on the Harris soils.

SOILS

The soils of Victoria County have been formed under conditions of rather high average temperature, together with only moderate rainfall. The soils vary considerably in characteristics, the broader soil group differences being due to the varied character of the original parent materials and to the influences of climate on these materials, whereas slight soil differences are produced by lack of uniformity of soil development caused by inequalities in relief, drainage, and physical assortment of surface materials.

The county lies very near the boundary between two great climatic regions of the State, the humid, where rainfall is sufficient to keep the soil washed free of an excessive accumulation of comparatively pure deposits of salts or compounds, and the subhumid, where rainfall is so low that leaching of the soil is insufficient to prevent lime carbonate accumulations. As a whole the soils are more nearly humid-region than subhumid-region soils. This is shown by their acidity and by the natural vegetation.

There are several well-developed belts in the county which comprise groups of related soils. These belts lie parallel to the coast and extend over a considerable region of the coast prairie section of the State through all the coast counties and over some of the regions farther inland.

These soil groups owe their common characteristics as well as their individual general soil characteristics to the following causes: (1) Original parent material; (2) topography and drainage; and (3) climatic influences.

In general the parent materials from which the soils have been formed represent unconsolidated water-laid deposits of sand, clay, and gravel formations of youthful or comparatively youthful geologic age. Little change in surface relief has taken place since the emergence of these formations from the sea. The soils of the county may be grouped, on the basis of soil characteristics and associated topographic and vegetative relationships, into three general areas as follows: (1) Dark-colored soils; (2) light-colored soils; and (3) alluvial soils.

The general outline of these main soil belts is shown in Figure 2.

Geologically, the formations giving rise to the soils of these belts comprise geologically young or unconsolidated deposits.^{4 5} The soil belts include various soils of related characteristics, the groups within each belt being closely related, and the mature soils of each belt differing largely in relation to parent material and climatic influence on that material. They have been grouped into series under each of which are one or more soil types. In the following pages the series

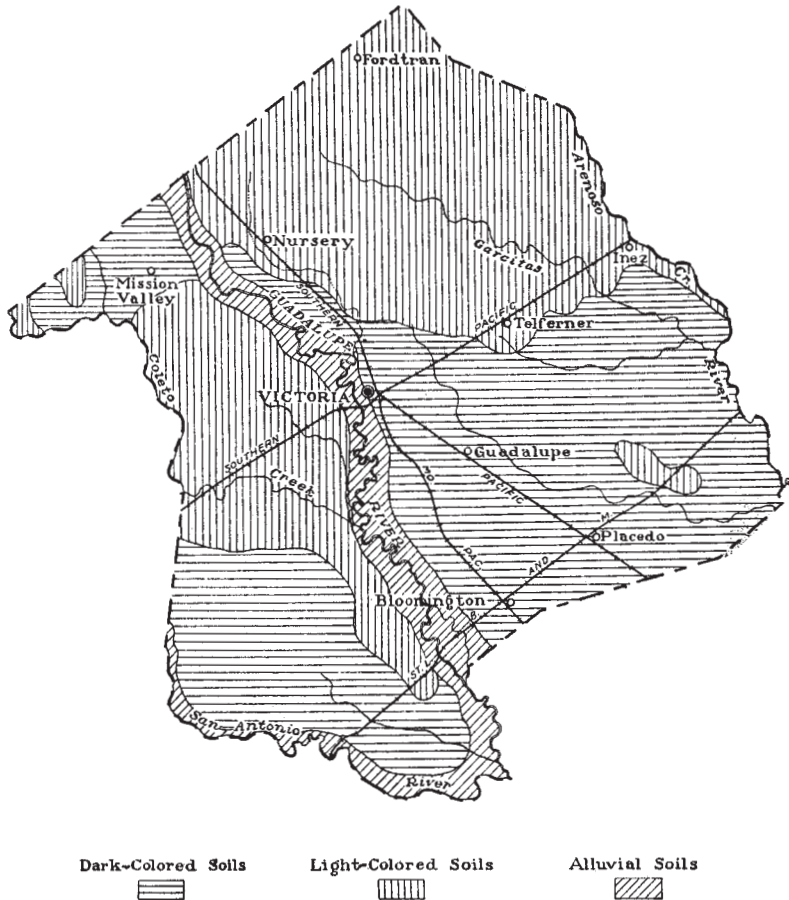


FIGURE 2.—Sketch map showing main soil belts in Victoria County, Texas.

characteristics of each group will be described first, followed by those of the several soil types.

Soils of the Lake Charles series are characterized by dark surface soils and dark subsoils which at a depth of several feet overlie yellow or cream-colored marl. These soils are typically developed on the Gulf coast prairie and occupy large areas near the coast.

A profile of the Lake Charles soils shows three distinct soil horizons, though in the clay there is little difference between the surface

⁴ DEUSSEN A. GEOLOGY OF THE COASTAL PLAIN OF TEXAS WEST OF BRAZOS RIVER. U. S. Geol. Survey Prof. Paper 126, 139 p., illus. 1924.

⁵ BAILEY, T. L. THE GEOLOGY AND NATURAL RESOURCES OF COLORADO COUNTY. Tex. Univ. Bul. 2333 159 p., illus. 1923.

soil (A) and the subsoil (B). The surface soils are black, very dark brown, or very dark gray and range in thickness from 10 to 15 inches. The surface soils, which show no lime carbonate by field test with hydrochloric acid, merge into black or very dark-gray clay, also showing no lime carbonate. The structure is massive and though cracks extend downward causing a vertical cleavage into long slabs or broad columns, they are broken apart into irregular large masses of no distinctive shape. The dark-gray or black clay subsoil merges gradually into a gray calcareous clay layer of varying thickness, in perfectly flat areas being but a few inches thick, and simply representing a zone of transition of the dark clay into the parent marl beneath. This layer carries some small hard lime carbonate concretions. In the virgin soil of the heavier types (the clay and in places the clay loam) this gray horizon is wavy and crops out on the surface at the crests of the low hog-wallow humps or elevations carrying the lime carbonate to the surface where the concretions may be seen thickly strewn. A few feet away the gray horizon lies in the depressions of the hog wallows 3 or 4 feet below the surface and just above the marl, as a thin band of material lying between horizons B and C. In some such places, the material is not calcareous except near the upper part of the marl, though it contains some concretions. In flat representative areas the yellow or cream-colored crumbly clay marl lies from 4 to 5 feet below the surface. The marl contains a large number of hard white lime carbonate concretions and many soft floury lumps of the same material. At a depth ranging from 20 to 30 feet and probably deeper the marl, in places, rests on deep beds of fine sand and in some places on rounded gravel.

As a rule the surface soils of the Lake Charles soils are neutral or slightly acid in poorly drained positions and show no lime carbonate when tested with hydrochloric acid. In the virgin soil, however, nearly 50 per cent of the surface soil is calcareous, on account of the exposure of the gray calcareous clay at the crests of the hog-wallow humps.

The Edna soils have two main horizons, with minor subhorizons. These soils have gray surface soils which are abruptly underlain by tough very heavy gray clay subsoils. The subsoils merge at a depth of several feet into gray or mottled gray and yellow sandy clay, the upper part of which in some places carries lime carbonate concretions in a narrow zone, although the fine earth soil material from the surface down gives no reaction with acid. The surface soils are characteristically compact on drying and the subsoils, even where sandy, are very tough and hard. These soils border the outer margins of the dark-soil section of the coast prairie, are flat, and have extremely slow surface and interior drainage. The subsoils on drying in exposed sections crack vertically, the cracks being crossed by small, approximately horizontal fissures. The material is columnar in structure, the cleavage of the particles being approximately square which causes the breakage into rectangular blocks with the longer dimension vertical. The blocks subdivide by smaller fissures into small squarish blocks or clods from 1 to 2 inches in length, and these are broken into finer fragments only with considerable pressure. The lower subsoil layer carries a few black concretions throughout a zone of varying thickness.

Although the main color of the subsoil is gray, small spots of reddish yellow occur with streaks of yellow radiating in irregular blotches into the gray. Apparently some of these colors form around or are caused by the disintegration of the black concretions and particles, many of which are soft or apparently weathered within a surrounding red or reddish-yellow bed. The Edna soils are acid in reaction, both in their surface soils and subsoils, though at a depth of several feet the parent material, in the zone of black concretions, is neutral or slightly alkaline. The surface of the Edna sandy soils is characterized by small low rounded mounds of fine sand. The lower subsoil layers at a depth of several feet contain, in many places, concretions of carbonate of lime, and in other places some fine particles of soft white material which does not effervesce with hydrochloric acid and which probably is lime sulphate.

The surface soils of the Hockley soils are light brown, and they are underlain by rather heavy dense mottled gray and yellow clay subsoils containing an appreciable amount of fine sand in the lower part. At a depth of several feet the subsoils merge either into calcareous clay several feet thick, fine sand, or fine sandy clay. The soils are acid in reaction throughout all layers except those of the deep calcareous clay, but the surface soil and the upper part of the subsoil are acid even over the calcareous clay. Black concretions, consisting of iron and manganese, are disseminated throughout the subsoil. They are surrounded by brownish, reddish, and yellowish material. The subsoil is dense and cohesive but on drying vertical cracks extend downward forming columnar bodies crossed by irregular transverse cracks, breaking the columns into irregular curved bodies with glistening plane surfaces. Each body is from 1 to 2 inches long. The material breaks apart readily when moist and without great force when dry. The Hockley soils appear to be developed mostly by the weathering of clays and sands of the Lissie formation. They occupy large areas of the better-drained parts of the coast prairie.

The soils of the Katy series are characterized by light-brown or grayish-brown surface soils abruptly underlain by mottled gray and red rather heavy clay. The surface soil is from 10 to 20 inches thick, acid in reaction, and moderately friable. The subsoil merges downward at a depth ranging from 2 to 3 feet into mottled red and gray fine sandy clay. In the southern part of the county small areas are underlain at a depth of 4 or 5 feet by calcareous clay or calcareous fine sand, and some lime-carbonate concretions are found at this depth.

To a depth ranging from 8 to 15 inches the soils of the Susquehanna series are grayish brown or in places light brown. Beneath this layer is generally but not everywhere a layer of light grayish-brown or yellow material from 2 to 5 inches in thickness, which passes abruptly into red and gray mottled heavy clay, very plastic and sticky when wet and extremely hard when dry. At a depth ranging from 30 to 40 inches is gray clay or sandy clay, mottled or splotted with red, the red decreasing with depth and becoming almost entirely absent at a depth ranging from 4 to 5 feet, at which depth gray sandy clay, containing a few red, yellowish-brown, or brown mottles, is reached. This lower layer represents the parent material, which may include a thin stratum of quartz or chert gravel. In some places

the material below a depth of 4 or 5 feet consists of a mixture of sand and gravel, in some places cemented by the gray sandy clay. In some places a calcareous zone containing small lime concretions occurs at a depth ranging from 5 to 6 feet.

The Susquehanna soils are timbered upland soils. In Victoria County they occur only in the area of light-colored sandy soils of the post-oak belt in the northern and northwestern parts.

Soils of the Goliad series are characterized by dark-brown or black surface soils underlain by dark-brown, brown, or reddish-brown clay or clay loam at a depth ranging from 12 to 18 inches. The upper part of the subsoil consists of reddish-brown clay loam, or in a few places clay, which grades into red clay loam or clay. At a depth ranging from 18 to 36 inches a more or less sandy caliche, or bed of soft almost pure carbonate, begins and in places extends to a depth beyond 12 or 15 feet. In many places, between the red subsoil material and the caliche, there is a thin layer of buff-brown highly calcareous clay loam or silty clay loam. The lower part of the subsoil may contain a few lime concretions. The surface soil and upper subsoil layer show no reaction with acid when tested for lime carbonate.

The Goliad soils occur in the vicinity of Mission Valley. They have developed from the Reynosa formation, and are influenced somewhat by the lower Lissie formation, the latter probably being responsible for the gravel occurring in the Goliad soils occupying a strip of country immediately west of the Guadalupe River. These are strong, productive soils, in which good drainage has developed. The vegetation consists mainly of leguminous species, such as mesquite, brazil, huisache, catclaw, *lignum-vitae*, agrito, and a large number of thorny shrubs known locally as chaparral, together with prickly-pear, live oak, granjeno, and others.

The lighter-textured members of the Wilson series have dark-gray or ash-gray surface soils, passing at a depth of about 6 inches into dark-gray or black clay, or clay loam. Neither surface soil nor subsoil effervesces with hydrochloric acid above a depth ranging from 24 to 30 inches. The heavier-textured soils are dark-gray or black clay loam or clay to a depth of approximately 30 inches, and these also do not effervesce on application of hydrochloric acid. Gray, brownish-gray, cream-colored, and in some places highly calcareous buff clay (marl) underlies all the soils of the series. The marl contains soft and semihard lime-carbonate bodies especially in the upper 18 inches of the layer. This material continues to a depth of more than 6 feet without much change.

Soils of the Wilson series occupy flat or nearly level areas. The surface is hog wallowy. The areas are timbered with a growth of post oak, some mesquite, and a rather dense chaparral growth and huisache.

The soils on the mounds are calcareous from the surface downward, and lime concretions are scattered over the surface in some places. On the mounds the soil profile shows about 6 or 8 inches of gray or brownish-gray calcareous clay, with numerous lime concretions in some places. Below this layer and continuing to a depth ranging from 40 to 48 inches is brownish-gray or cream-colored clay marl which is highly calcareous, containing some lime concretions and soft white lime aggregates. This layer grades into cream-colored or buff highly calcareous marly clay, containing much soft white lime

in large and small aggregates, which extends to a depth of more than 6 feet without much change.

These two profiles may be seen from 4 to 6 feet apart. The mounds generally lie from 6 to 12 inches above the level of the intervening material of the depressions.

The DeWitt series includes the timbered correlatives of the Hockley soils. The surface soils are grayish-brown or brown ranging from 10 to 15 inches in thickness. They are slightly lighter in color than the Hockley soils. An inch or two of yellowish-gray or light-brown material occurs in the lower part of the layer which passes abruptly into rather heavy dense yellow clay mottled with gray, or it may be yellowish brown and gray mottled. The gray mottling increases with depth. At a depth ranging from 36 to 48 inches the material is gray or mottled gray and yellow sandy clay, in some places splotched with red around black iron and manganese concretions, which are in places especially prominent. The yellowish mottling decreases with depth, and the sand content increases, especially below a depth of 72 inches. The surface soil and subsoil are in general acid or strongly acid. At a depth ranging from 60 to 72 inches there is in many places yellow and gray calcareous sandy clay, containing some semihard lime-carbonate concretions. Even where this calcareous layer is absent tests show an alkaline reaction at a similar depth. In a few places sand and gravel strata from a few inches to a foot or more thick are found below a depth of 6 feet. In some places deep stream cuts show the presence of sandy caliche at a depth of 10 feet, the caliche layer being more than 3 feet thick as a rule.

Soils of this series occur only in the post-oak belt in the northern and northwestern parts of the county, and along the tongues extending southward from this belt onto the upland bordering the major drainage ways.

The surface soils of the Norfolk soils are gray. They are underlain by yellow subsoils. In Victoria County these soils represent bodies of land composed of deep loose sand which has probably been assembled by the assorting action of stream currents.

The Harris soils occupy semimarshy land bordering salt water. They lie at a very low elevation and reach from the coast up along some large streams for several miles in broadly indented coast margin stream-valley entrances. The Harris soils have gray surface soils and light-gray or bluish-gray clay subsoils which extend to a depth of several feet. In many places the subsoils are sandy throughout or include a layer of fine sandy material. These soils are impregnated with salt (sodium chloride) from salt water which is, at times, forced over the surface by heavy winds. The soil material is derived largely from sediments brought down by streams and deposited in shallow salt-water bays. The land supports a salt-marsh vegetation and in places farthest from salt water some fresh-water marsh vegetation.

The Trinity series includes soils with black, very dark-gray, or dark-brown calcareous surface soils and dark calcareous subsoils. The structure is granular, and the heaviest soils break naturally into a friable mass of fine grains. The soil material has been transported largely from the calcareous black prairies of the State and from the Edwards Plateau, a limestone region.

Soils of the Catalpa series are very closely associated with those of the Trinity series. They have brown deep calcareous granular surface soils and brown calcareous granular clay subsoils. The materials from which these soils were formed were washed from the same areas as the Trinity material, but being deposited in slightly better-drained positions, less organic matter has become mixed with the soils, giving a lighter color.

The Guadalupe series includes soils with brown or light ash-brown surface soils which assume a rather grayish color on drying. The lighter-textured members of the series are the lightest in color. The subsoils between depths of 18 inches and 3 feet are coarser in texture than the surface soils and consist of materials which may be fine sand, fine sandy loam, silt loam, or silty clay loam, the lighter-textured materials prevailing beneath the lighter surface soils. The subsoils range in color from light brown to grayish brown and yellowish brown. In many places the subsoil to a depth of several feet is composed of several layers of the various-textured materials which merge without sharp lines of textural or color differences. At a depth of several feet the subsoil consists of heavy silty clay which extends downward many feet. Both surface soils and subsoils are very calcareous. They are prevailing crumbly and friable, in plowed fields even the heaviest materials breaking down naturally into coarse grains.

The Guadalupe soils occupy stream bottoms, are alluvial in origin, and are the most favorably situated flood-plain soils so far as drainage is concerned.

The Bienville soils have brown or brownish-gray surface soils underlain by yellowish-brown or grayish-brown subsoils which merge at a depth of several feet into red or mottled red and gray fine sandy clay. The soils are not calcareous.

The Milam series is represented by soils having brown surface soils underlain by red sandy clay subsoils which at a considerable depth rest on sand or gravel.

The Bell series is represented by soils having the following common characteristics: Calcareous dark-gray, very dark-brown, or black surface soils, ranging from 10 to 15 inches in thickness and grading through a thin transitional layer into black, very dark-gray, or very dark-brown calcareous clay which extends downward to a depth ranging from about 2 to 4 feet. This layer, in turn, is underlain by a layer of gray or yellow, or a mixture of the two, clay containing lime-carbonate concretions and passing within a few inches into the substratum of yellow or cream-colored chalky clay marl which contains soft and hard white lumps and concretions of lime carbonate. The marl continues downward for several feet, in many places becoming very sandy, and rests on beds of sand or gravel which in some places are strongly calcareous, and in other places are noncalcareous. The soils are of granular structure, the coarse hard fragments and clods breaking down naturally in the cultivated fields on drying after rains or with minimum pressure by tillage implements. An exposed soil profile shows the structure to be columnar, the air-dry surface soil and subsoil separating into long vertical segments which break by transverse fracture into large irregular fragments. The Bell soils occupy prevailing smooth flat second bottoms or terraces which are high above ordinary overflows.

The Coletto soils are gray and contain no lime carbonate. They occupy small high-bottom areas along small streams and are formed by sediments washed from local areas.

The Johnston series includes alluvial soils having dark-brown or black surface soils, overlying, as a rule, dark-brown or brown clay loam or clay subsoils. Owing to local conditions, the subsoil may be gray clay loam or clay, mottled in places with brown. The Johnston soils are developed in first bottoms along the larger creeks of the county and are subject to overflow.

Table 2 shows the acreage and proportionate extent of the several soils mapped in Victoria County.

TABLE 2.—*Acreage and proportionate extent of the soils mapped in Victoria County, Texas*

Type of soil	Acres	Per cent	Type of soil	Acres	Per cent
Lake Charles clay.....	114,624	21.1	Wilson clay loam.....	960	0.2
Slope phase.....	5,888		Wilson clay.....	192	.1
Lake Charles clay loam.....	44,992	8.8	DeWitt fine sandy loam.....	27,264	5.1
Slope phase.....	5,184		Gravelly subsurface phase.....	1,728	
Lake Charles fine sandy loam.....	21,824	3.8	Norfolk fine sand.....	7,360	1.3
Lake Charles fine sandy clay loam, slope phase.....	3,008	.5	Harris clay.....	1,856	.3
Edna fine sandy loam.....	105,664	20.7	Trinity clay.....	42,752	7.5
Shallow phase.....	12,352		Trinity fine sandy loam.....	1,088	.2
Edna fine sandy clay loam.....	9,920	1.7	Trinity fine sandy clay loam.....	2,496	.4
Edna clay.....	1,536	.3	Catalpa clay.....	5,568	1.0
Hockley fine sandy loam.....	84,096	14.8	Guadalupe silty clay loam.....	11,136	2.0
Katy fine sandy loam.....	2,816	.5	Guadalupe clay.....	3,648	.6
Gravelly subsurface phase.....	64		Guadalupe fine sandy loam.....	3,328	.6
Susquehanna fine sandy loam.....	6,656	2.2	Bienville fine sand.....	3,584	.6
Gravelly subsurface phase.....	5,888		Milam fine sandy loam.....	2,112	.4
Goliad fine sandy loam.....	4,224	2.7	Bell clay.....	4,480	.8
Shallow phase.....	576		Coletto fine sand.....	2,304	.4
Slope phase.....	10,752	1.0	Johnston fine sandy loam.....	768	.1
Goliad clay loam.....	4,672		Johnston clay loam.....	512	.1
Shallow phase.....	1,280	.1	Rough broken land.....	64	.1
Wilson fine sandy loam.....	384		Total.....	589,600	

LAKE CHARLES CLAY

Typical areas of Lake Charles clay have a black or dark-gray clay surface soil, showing no lime carbonate by field test, which merges, at a depth ranging from 3 to 4 feet, through gray calcareous clay containing a few small lime-carbonate concretions, into cream-colored or yellow marl which in most places lies at a rather uniform depth of about 5 feet. The surface soil becomes slightly lighter colored below a depth of 10 or 12 inches. In virgin areas, the surface has a microrelief showing rounded or elongated elevations and depressions generally known as hog wallows. These are only a few feet in diameter. In the depressions the soil is black, in some places continuing to a depth of 5 feet with little or no change. Practically all the elevations or humps are composed of gray calcareous clay containing lime-carbonate concretions. In many places the concretions are scattered over the surface. A profile across a number of mounds and depressions shows the gray layer at or near the surface on the mounds and several feet beneath the surface between the mounds. The unchanged marl, however, lies at about the same depth below the surface of both humps and depressions. When the virgin soil is plowed the fields appear very spotted, black and gray, even after the

mounds have dissappeared through continued cultivation. Gradually, however, the surface soil, where cultivated, becomes smooth and uniformly black, though the black color extends only from 6 to 12 inches deep over the former mounds. When first cultivated, the mixture of the calcareous soil of the mounds with that of the depressions makes the surface soil calcareous, but with continued cultivation, even where the surface soil is shallow, it becomes neutral and shows no lime carbonate.

When wet, the surface soil is very sticky. On drying, it cracks deeply in virgin areas, the cracks extending downward to the marl. The soil material breaks up naturally into small angular particles where exposed to the air, the vertical blocks or slabs being crossed with numerous fine irregular cracks which cause the soil mass to fall apart into fine clods, these disintegrating further into coarse grains. Under cultivation, the process of disintegration is accelerated by working the soil when slightly moist. Some areas of the soil, which occupy slightly depressed poorly drained positions, many of them adjacent to soils of the Edna series, are dark gray, lie on a smoother surface, and crumble less readily than the typical soil. As a rule, all the Lake Charles clay works into a very friable mellow seed bed without great difficulty, and a loose surface soil several inches thick is readily maintained throughout the crop-growing season. In exposed cuts the dry dark surface layer breaks apart with considerable pressure into great irregular masses.

The gray subsoil layer is slightly more crumbly than the dark surface layer, but there is no sharp line of demarcation between the surface soil and subsoil. The gray layer, in turn, merges gradually into the marl beneath, in many places through a mottled gray and yellow layer. Small black concretions surrounded by spots of yellow are found in places in the lower part of the gray clay layer. The marl is a crumbly friable very calcareous clay, containing numerous white lime-carbonate concretions and soft floury lumps of the same material. It is in few places less than 20 feet thick, in many places thicker, and it is underlain by sandy beds. However, the sand has been seen in places at depths between 6 and 8 feet. Near the coast a deep-red calcareous clay has been seen in some deep cuts at a depth ranging from 8 to 10 feet.

In places the material cracks in curved approximately horizontal directions, resulting in banded layers resembling miniature geological anticlines. The red clay appears less calcareous than the yellow marl and contains fewer lime-carbonate concretions. When dry it breaks easily into small irregular fragments with curved very slick surfaces.

Lake Charles clay is a very extensive and important soil in Victoria County, as well as in other counties in the coast prairie belt. About 80 per cent of the land in the central part of the county is in cultivation. Some larger bodies, which are still included in large livestock ranches in the southeastern and southwestern parts of the county, are uncultivated. Where uncultivated, the land supports a very heavy growth of native prairie grasses which are highly prized by ranchmen for their nutritious qualities.

The main crops grown on Lake Charles clay are cotton, corn, sorgo and similar forage crops, and some of the grain sorghums. The soil is well suited to these crops and in favorable seasons yields are good if insect pests do no great damage. Cotton, the main cash crop, pro-

duces from one-half to as much as 1 bale to the acre when insect pests do not prevent. Corn yields from 25 to 40 bushels, and ordinarily it ranks second to cotton in acreage. The other crops are grown in small acreages, sorgo producing 4 or 5 tons of hay or fodder to the acre, usually from two cuttings a year; and Sudan grass (pl. 1, B.) which yields two cuttings in one season producing around a ton of hay at each cutting, is also used for grazing farm animals. Grain sorghums do well, yielding from 30 to 40 bushels of grain at the first harvest and at least half as much at the second harvest. The native grasses are cut for hay on many good-sized areas of the soil, in many seasons yielding 2 tons to the acre from two cuttings. All farmers grow fruits, berries, and vegetables for home use.

The soil is naturally very productive and withstands dry weather conditions very well. It is best utilized for farming where drainage conditions are good. Although some of the soil crusts and bakes on drying after rains, thus retarding the germination and growth of seed and young plants, this condition is said to be ameliorated to a considerable extent by plowing under all kinds of vegetable matter, such as crop residues, pea vines, and other organic materials. Only small quantities of commercial fertilizers have been used on the soil, and no reports of any great advantage derived have been made. The cotton root rot appears to do more damage on this than on any other soil in the county. The injury appears greatest on the most friable areas of the soil and where the soil is alkaline or neutral in reaction. On the more poorly drained areas where the soil is inclined to crust and bake the disease seems less deleterious.

The great problem in connection with this soil seems to be drainage, and where this is provided the land is considered of great value. Much of the land is better drained than formerly, owing to the establishment of drainage systems with ditches extending through the more poorly drained areas.

Lake Charles clay, slope phase.—Lake Charles clay, slope phase, is identical with Lake Charles clay, except that the comparatively thin, and in many places calcareous, black clay surface soil merges through the calcareous gray clay subsoil into the marl substratum at a depth usually within 3 feet of the surface.

A glance at the soil map shows that the total area of the slope phase is small. The bodies occur only in long narrow strips along the streams, and usually form the bluff line belts.

Although this is a valuable agricultural soil in many places, it is seldom cultivated, perhaps less than 5 per cent being under the plow. It is better drained than the typical soil and produces good crops on the gentle slopes. The same crops are grown with about the same yields as on the typical soil. At present, the land is utilized mainly for grazing ranch cattle and farm animals. Where cultivated the soil erodes severely.

LAKE CHARLES CLAY LOAM

The surface soil of Lake Charles clay loam is black or dark-gray heavy clay loam or fine sandy clay loam from 8 to 15 inches thick, and as a rule shows no reaction with field test for lime carbonate. It is underlain by dark, nearly black, or very dark-gray clay which is heavy and very similar to the subsurface clay of Lake Charles clay. This material also contains no lime carbonate in the upper part, but

at a depth of 3 or 4 feet it merges into gray or dark-gray calcareous clay containing small lime-carbonate concretions. At a depth ranging from about 4 to 5 feet the clay merges into yellow or cream-colored marl which contains lime-carbonate concretions and soft lumps of the same material.

Although as a rule the soil is not calcareous, it has a fine-grain structure and is readily pulverized with tillage implements. In some places the surface is dotted with mounds as is Lake Charles clay. The mounds are rather lower and broader and do not produce such inequalities of soil as in the clay member. In some of the hog-wallow humps the calcareous gray clay is exposed at the surface. As a rule, however, very little of the surface soil is calcareous.

Lake Charles clay loam, locally called "mixed black land," is rather extensive in Victoria County. It occurs in many small and a few good-sized bodies closely associated with Lake Charles clay in the southern part of the county in the vicinity of McFaddin, Lone Tree School, Dacosta, Placedo, and many other places throughout the dark-land part of the coast prairie.

The surface relief is similar to that of the clay member of the Lake Charles series. Surface drainage is fair in many places, though in the flatter areas the water stands for some time after rains unless the land is artificially drained. Some small drainage ways pass through or near most areas of the soils and, together with artificial ditches in many sections, remove the water readily.

Like Lake Charles clay, this is a prairie soil, the virgin areas being covered with a very heavy growth of native grasses similar to those growing on that soil. Probably 60 per cent of the land is in cultivation. Good-sized virgin areas are included in some of the large livestock ranches. The native grasses, which are highly nutritious, are used as pasturage for range and farm animals.

The same crops are grown with about the same yields as on Lake Charles clay. Many farmers prefer the clay loam to the clay, owing to the better drainage and to less inconvenience experienced in handling this soil when moist. The clay member is recognized as probably somewhat more productive naturally, but owing to greater difficulty in working on account of the heavy soil and poorer drainage, average yields of cotton, corn, sorgo, and the grain sorghums are about the same. Gardens and small orchards do as well or a little better than on the clay. The soil is well suited to all kinds of vegetables, blackberries, dewberries, figs, sweetclover, bur clover, and various other crops. A few citrus-fruit trees growing on this soil indicate that where drainage is good, the land is well suited to these fruits.

Lake Charles clay loam, slope phase.—The surface soil of Lake Charles clay loam, slope phase, is similar to that of the clay loam, but it is a little browner. At a depth ranging from 30 to 40 inches it merges into yellow or cream-colored marl. There is considerable variation in the depth of the surface soil and in the thickness of the underlying layers. In rather steep areas, the marl may be reached just below the surface soil with very little or none of the calcareous gray layer intervening. In places where the calcareous clay or marl lies within a foot or two of the surface, much of the surface soil is highly calcareous, but where the calcareous materials lie 2 feet or more below the surface, the surface soil and subsurface soil are usually

not calcareous, as evidenced by field tests with hydrochloric acid. Land of the phase consists of the typical soil which has had the deep dark surface layer partly or entirely removed by erosion. The soil material is granular and none of it is inclined to bake or crust over on drying to such an extent as some of the more poorly drained soils. It works up into a friable seed bed of good tilth.

This soil occurs in numerous small bodies or narrow strips along many of the stream valleys. Probably less than 50 per cent of the land is in cultivation to the same crops as those grown on the slopes of other Lake Charles soils.

LAKE CHARLES FINE SANDY LOAM

The surface soil of Lake Charles fine sandy loam consists of black, dark-gray, or very dark-brown fine sandy loam or loamy fine sand which does not effervesce when tested with hydrochloric acid. It ranges from 10 to 16 inches in thickness and merges into black or dark-gray rather tough clay or fine sandy clay also without effervescence in acid. Below this the material is essentially like that under the other Lake Charles soils. Although this description holds for the typical soil, several variations occur over many small areas.

Where these soils are grading into soils of the Edna series the surface soil is grayish brown in many small spots. On some sloping areas the marl, in places, lies considerably nearer the surface than in smoother areas. In prairie positions near areas of Edna and Hockley sandy soils the clay upper subsoil layer is splotched or spotted with very small red, reddish-yellow, and rust-brown mottles in many places. The material merges at a depth of about 2 feet into rather tough gray clay containing slight yellow streaks.

Small circular mounds of dark fine sand, ranging from 2 to 3 feet in height and from 20 to 30 feet in width, occur in a few places over the surface.

Lake Charles fine sandy loam occurs in small spots scattered throughout parts of the dark soil section of the coast prairie, in association with other Lake Charles soils, and in many places it represents the merging of Lake Charles soils into the light-colored sandy soils. This accounts for the lack of uniformity in the color of the surface soil and subsoil in many places.

Though not extensive this is a very valuable soil. It is highly esteemed by farmers by whom it is locally known as "black sandy land" or "dark sandy land." Probably 70 per cent of the soil is in cultivation, the remainder being covered with a heavy growth of native prairie grasses, which are utilized as pasturage for ranch and farm animals. The crops grown are the general farm crops common to the region, with about the same yields as on the heavier soils. This soil is especially suited to vegetables, fruits, and berries.

LAKE CHARLES FINE SANDY CLAY LOAM, SLOPE PHASE

Lake Charles fine sandy clay loam, slope phase, to a depth ranging from 8 to 14 inches consists of very dark-brown or black heavy friable fine sandy clay loam, which as a rule shows no effervescence with hydrochloric acid. Below this depth, the characteristics of the soil are identical with those of typical Lake Charles soils. In several places tests with hydrochloric acid showed the presence of some free lime carbonate from the surface downward.

The surface relief ranges from nearly level to somewhat sloping, and drainage, which would otherwise be restricted by the heavy character of the subsoil material, is fair or good. Areas of this soil lie adjacent to some of the larger drainage ways, in many places occupying first-bottom or high first-bottom positions along the streams. The soil occurs mainly in the northern part of the county along Garcitas River and Arenoso Creek.

This soil has probably developed from a calcareous clay of the Beaumont clay geologic formation, which has been exposed by erosional forces through removal of the overlying material. It lies from 10 to 15 feet above the original water level which is sometimes but rarely reached by high water in the streams.

The soil has developed under prairie conditions, and is at present treeless. It is covered with grass, chiefly of the short-grass varieties, with some of the bunch grasses. The land furnishes good grazing, to which purpose it is at present devoted.

This is a good strong soil and could be used in the production of the crops commonly grown in the region. The natural grasses could be supplemented with sweetclovers or bur clovers, particularly the spotted bur clover (*Medicago arabical*) and the yellow-flowered bur clover (*M. denticulata*) which is common along the roadsides. Subterranean clover (*Trifolium subterraneum*) would also be a valuable addition to the grasses now growing on this soil, especially in supplying pasturage during the winter.

EDNA FINE SANDY LOAM

The surface soil of Edna fine sandy loam, to a depth ranging from 8 to 14 inches, consists of fine sandy loam which is light gray when dry but dark gray or brownish gray when moist. When moist the material is friable and loose with very slight coherence of the particles, but on drying it packs or bakes into a hard bricklike amorphous mass. The surface soil rests directly on the clay subsoil, long horizontal cracks in exposed cuts of the dry soil showing the junction of surface soil and subsoil. As a rule, the lower inch or two of the surface soil is of a lighter bleached-out gray color than the soil above. The subsoil consists of a very heavy dark-gray clay, in most places slightly mottled with yellow or reddish yellow and in some places with small spots of red. When dry the clay is very tough and hard. At a depth ranging from 20 to 30 inches the clay grades into gray fine sandy clay more or less mottled with yellow and extremely tough. Between depths of 40 and 60 inches the clay subsoil becomes increasingly sandy and in many places more yellow in color. In places between depths of 3 and 6 feet the subsoil contains lime-carbonate concretions and in many places some whitish particles which do not effervesce with hydrochloric acid, but in many places the material effervesces in acid.

Throughout the subsoil below a depth of 2 or 3 feet are small fine black iron or manganese concretions which form the centers of brown and reddish-brown spots. With distance from the concretions, these spots gradually fade in color to shades of yellow. The surface soil and upper part of the subsoil are strongly acid, between depths of 3 and 4 feet the clay is neutral, and below that depth it is alkaline in reaction even where field tests show no effervescence. Fine sand lies from

10 to 15 feet below the surface in places and probably at greater depths in some places.

The surface soil on drying forms a solid mass having no segregation of particles or aggregates. In exposed cuts the heavy clay subsoil on drying breaks into columns several inches in diameter, and horizontal cross fissures break the columns into approximately rectangular blocks which are somewhat longer vertically than horizontally. With considerable pressure these masses break into smaller clods of irregular shape and size.

Small circular dome-shaped mounds of fine sand are scattered over the surface in many places. They are from 1 to 2 feet high and from 15 to 30 feet in diameter.

Edna fine sandy loam occurs in a few large areas and many very small ones, in association with other soils of the Edna series. Some bodies are so small that they can not be shown separately on the small-scale map. The principal areas are in the northwestern half of the county and are separated from the coast by the dark-soil areas. Toward the inland side of the coast prairie the soil gives way gradually to large bodies of the Hockley and Katy soils. Some of the largest bodies are around Telferner and Inez in the eastern part of the county, and some smaller bodies lie west of Guadalupe River near McFaddin, Kemper City School, Fleming School, and Liberty School. On account of its tendency to bake, the soil is known locally as "pack sand" or "run-together land."

The surface of Edna fine sandy loam is flat, and surface drainage is poor. Since the subsoil clay is dense and tough, water percolates very slowly. Water stands on the depressed areas a long time after rains, and the soil remains in a saturated condition for months during the winter. Small poorly developed drainage ways across the prairies carry off some of the surplus water very slowly, and in some areas drainage is accelerated by artificial ditches.

Though an extensive soil in Victoria County, probably not more than 5 per cent of the land is in cultivation. Many large areas are included in ranches, and here as well as elsewhere the principal use of the soil is for livestock grazing. The land supports a heavy growth of native prairie grasses, which, though not so nutritious as the grasses on the Lake Charles soils, are of considerable value for livestock. A scattered tree growth, consisting of small post oak, live oak, huisache, and mesquite, occurs on areas adjacent to areas of DeWitt fine sandy loam.

In fields where the soil dries out early enough, it produces fairly good yields of the general farm crops. It is said that in dry seasons crops hold up well for a long time and do best with only a small amount of rain. Under the most favorable moisture conditions, cotton yields from one-third to one-half bale to the acre and corn from 15 to 25 bushels. The soil produces fairly good yields of sorgo, grain sorghums, and Sudan grass. Where drained and cultivated carefully this seems to be a fairly productive soil, best results being obtained where vegetable matter is plowed under for a good supply of humus. In many places the soil crusts and packs to some extent, and for this reason young plants are sometimes not able to come up.

One small very successful commercial orchard of Satsuma oranges grows on this soil near Telferner, from which generally satisfactory

returns have been reported for the last nine years. The soil responds to applications of barnyard manure and to the growing of such legumes as cowpeas. Figs were seen growing successfully in a number of places in yards and small home orchards.

Edna fine sandy loam, shallow phase.—The surface soil of Edna fine sandy loam, shallow phase, consists of fine sand or silty fine sand which is dark gray when wet but on drying becomes very light, almost whitish gray. It is from 3 to 8 inches deep. In other respects the soil is essentially like typical Edna fine sandy loam. It occurs in many small areas in close association with areas of the typical soil.

Practically none of the land is in cultivation but is used for pasture. The grass is much shorter and the stand is thinner than on the typical soil.

The results of mechanical analyses of samples of the surface soil, the subsurface soil, and several layers of the subsoil of Edna fine sandy loam, shallow phase, are shown in Table 3.

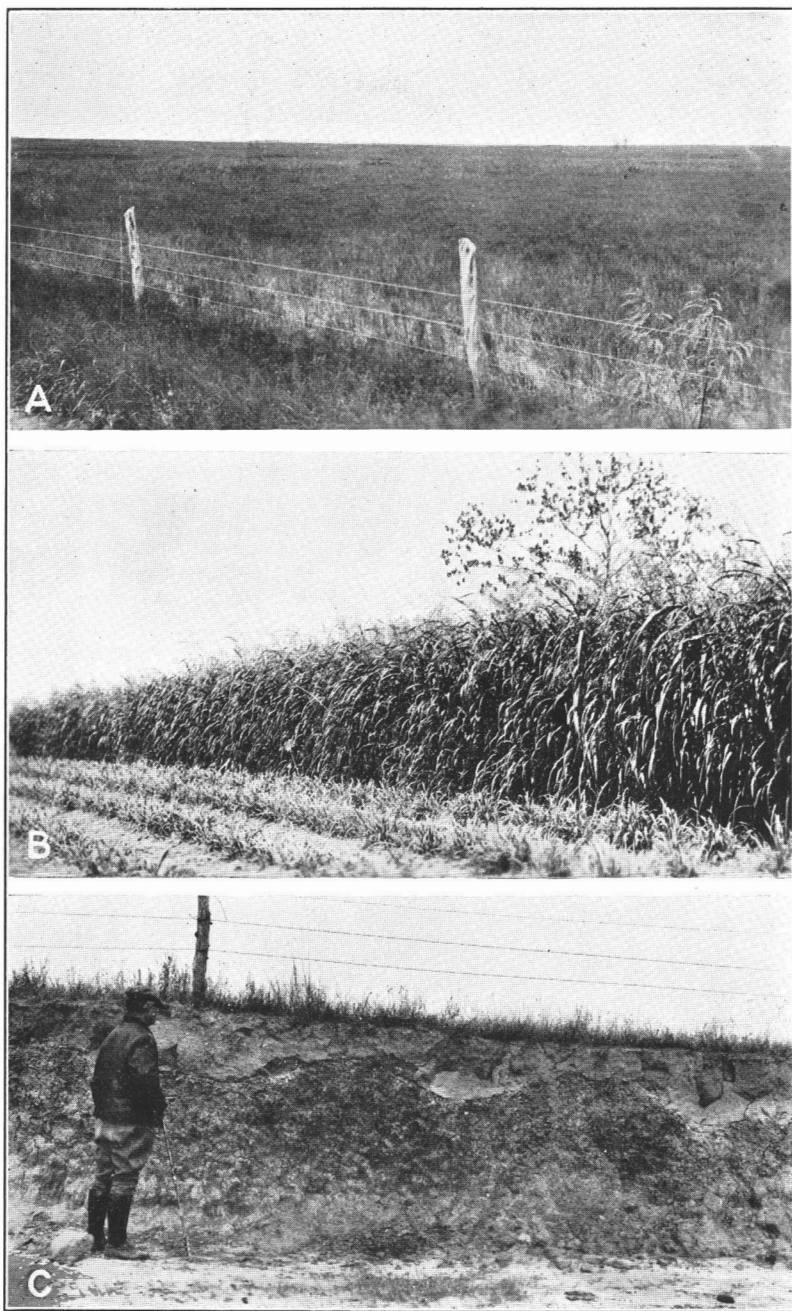
TABLE 3.—*Mechanical analyses of Edna fine sandy loam, shallow phase*¹

No.	Description	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
		<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
4474203	Surface soil, 0 to 4 inches.....	0.3	5.0	15.4	37.1	17.2	14.8	10.1
4474204	Subsurface soil, 4 to 12 inches.....	.2	5.1	12.1	27.4	14.1	12.5	28.6
4474205	Subsoil, 12 to 24 inches.....	.2	3.2	9.9	24.7	12.8	13.8	35.2
4474206	Subsoil, 24 to 40 inches.....	.3	4.3	12.6	29.3	14.5	14.0	24.9
4474207	Subsoil, 40 to 60 inches.....	.2	3.7	14.1	29.7	13.7	10.9	27.5
4474208	Subsoil, 60 to 80 inches.....	.1	3.2	10.9	30.5	15.3	12.4	27.7

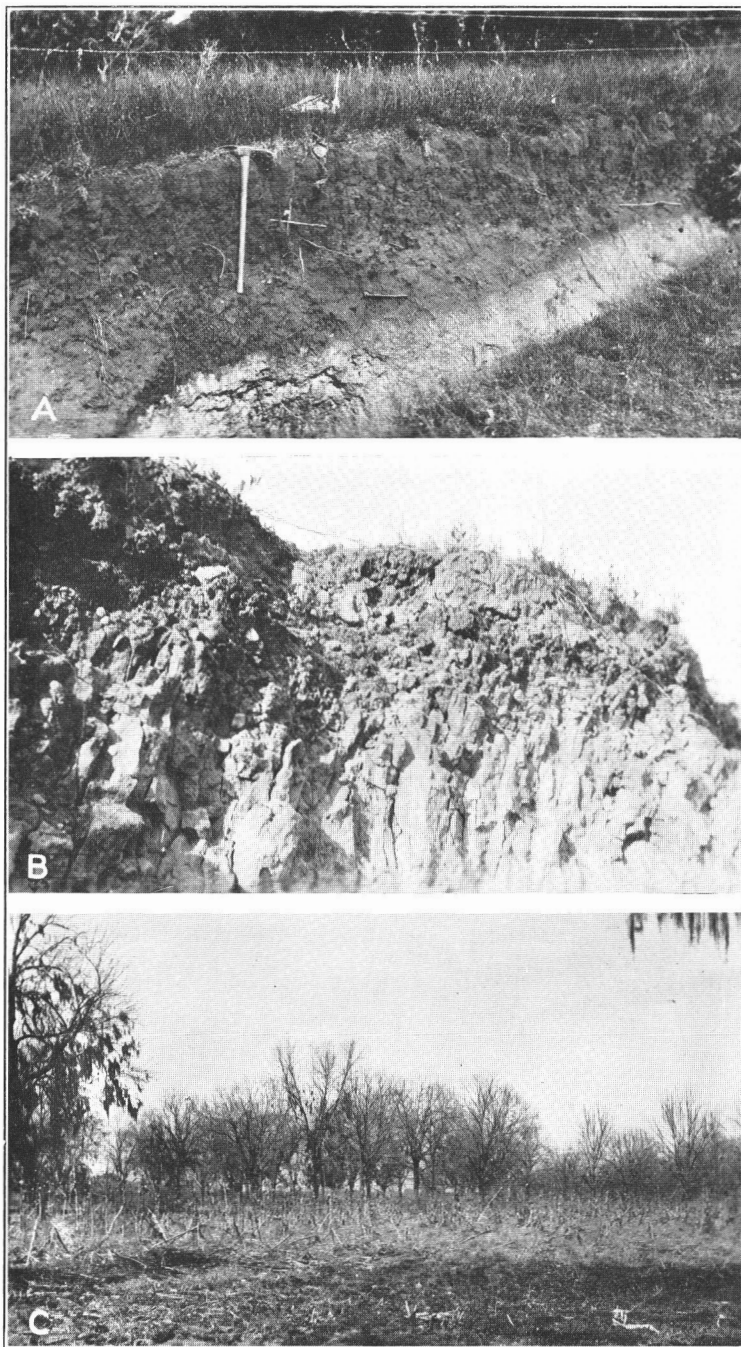
¹ After treatment with hydrogen peroxide.

EDNA FINE SANDY CLAY LOAM

The surface soil of Edna fine sandy clay loam is dark ash-gray fine sandy clay loam, in many places showing very slight mottlings of yellowish brown. On drying, the topmost surface soil assumes a very light whitish-gray color. The surface soil, which is from 8 to 12 inches thick, rests directly on the clay subsoil. On drying, the surface soil becomes very hard and is structureless. It breaks with considerable pressure into large irregular masses. The subsoil is very heavy dense dark-gray clay of almost uniform color but in many places contains tiny spots and streaks of red, reddish yellow, or yellow. At a depth ranging from about 2 to 3 feet the clay gradually merges into dark-gray or mottled gray and yellow fine sandy clay. A few thin seams or pockets of gray fine sand occur at various depths throughout the lower part of the subsoil. At a depth ranging from 4 to 5 feet the clay again becomes heavy, and light gray in color and continues so below a depth of 6 feet. In many places the clay contains small black concretions surrounded by bands of red and yellow material. White spots which do not effervesce in acid are present between depths of 4 and 5 feet. As a rule, lime carbonate does not occur above a depth of 6 feet either as a component of the fine earth or as concretions. The surface soil and upper part of the subsoil are both strongly acid in reaction but the lower part of the subsoil is alkaline in reaction at a depth ranging from 2 to more than 4 feet. The subsoil has little structure but dries out into a very hard solid mass which is broken



A, Typical relief of the coast prairie, occupied by soils of the Edna and Hockley series; B, Sudan grass on Lake Charles clay; C, a profile of Hockley fine sandy loam, showing wavy line of contact between the surface soil and subsoil



A, A profile of Golliad fine sandy loam; B, a profile of DeWitt fine sandy loam, showing the natural breakage of the subsoil material; C, native pecan grove on Guadalupe silty clay loam in the San Antonio River bottoms near McFaddin

apart into large irregular clods only with great difficulty. Many crawfish holes dot the surface in places.

Edna fine sandy clay loam is comparatively inextensive. It occurs, in close association with other soils of the Edna series, in many small areas scattered throughout the eastern and southern parts of the county. Small spots occur in small shallow depressions within areas of the Lake Charles soils. The soil is referred to by people of the county as "gray hard land" or "senna-bean flats."

The surface of the land is very flat, and this condition, together with the dense, almost impervious, consistence of the clay subsoil, makes this the most poorly drained soil in the county. Many areas become ponds for periods of several months during the winter. Many of the small areas are roundish and have no drainage outlet except through artificial ditches which, owing to the slight extent and low value of the soil, are few.

Practically none of the land is in cultivation. It is utilized mainly for the scant grazing afforded by the thin cover of short and coarse grasses of low nutritive value. The senna bean is the typical growth on the pondlike areas. If this soil were well drained and supplied with organic matter it would produce cotton, sorgo, grain sorghums, Sudan grass and other forage crops, and rice. Owing to the crusting of the soil on drying, difficulty is experienced in getting a stand of young plants in cultivated spots.

EDNA CLAY

The surface soil of Edna clay is gray or very dark gray in color, changing to a lighter color below a depth of 10 inches, but the texture does not change. Below a depth ranging from 30 to 40 inches small spots of lime carbonate are present but neither soil, subsoil, nor parent material contain enough lime carbonate in the fine earth material to effervesce in acid. At a depth of about 5 feet a hard compact fine sandy clay, the parent material, is reached.

Edna clay occurs in long, narrow depressions in the prairies and covers a very small total area.

Senna beans and coarse prairie grasses constitute the dominant natural vegetation.

HOCKLEY FINE SANDY LOAM

Hockley fine sandy loam has a surface soil from 12 to 18 inches thick. When dry it is light brown, grayish brown, or brownish gray in the topmost part. It is friable and rather loose, having very little coherence when moist. The surface soil rests rather abruptly on the clay subsoil. The contact line between the surface soil and subsoil varies in depth, ranging within a few feet from 6 to 20 inches. (Pl. 1, C.) Low dome-shaped mounds of fine sand occur in places. The subsoil is mottled gray, yellow, and in some places, red heavy dense clay. On drying in exposed cuts it breaks vertically and transversely into large fragments which are approximately cubical. These in turn break into smaller clods of about the same shape.

Hockley fine sandy loam is a rather extensive soil in Victoria County. It is the dominant soil in the vicinity of Nursery. Large areas occur in the northwestern half of the county. The soil is locally referred to as "sandy prairie land." It occupies the less flat areas

of the sandy coast prairie and is closely associated with Edna fine sandy loam. That part of the soil which is underlain by calcareous clay lies in the smoother situations on the same general level as soils of the Lake Charles series. Areas which are not underlain by calcareous clay lie in the higher parts of the coast prairies in the northern part of the county.

Most areas of Hockley fine sandy loam are undulating, though some areas near drainage ways are rather rolling with some short moderately steep slopes. Drainage is fairly good throughout most areas, much better than in the Edna soils. The subsoil is so dense that water passes downward very slowly. This may be considered a fairly drought-resistant soil as the dense subsoil holds a large store of water during dry seasons, enabling crops to grow for considerable periods without rain.

Probably not more than 2 per cent of the land is in cultivation. Much of it comprises cattle ranch lands not yet subdivided for farming. The soil supports a dense growth of coarse grasses of many species, the dominant ones being *Andropogons*.

In Table 4 are given the results of mechanical analyses of samples of the surface soil, the subsurface soil, and several layers of the subsoil of Hockley fine sandy loam.

TABLE 4.—*Mechanical analyses of Hockley fine sandy loam*¹

No.	Description	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
		<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
447410	Surface soil, 0 to 8 inches.....	0.5	6.2	17.9	38.4	16.8	12.1	8.0
447411	Subsurface soil, 8 to 15 inches.....	.6	6.6	18.0	38.9	16.6	11.2	8.1
447412	Subsoil, 15 to 24 inches.....	.0	3.6	9.2	20.1	9.1	6.6	51.3
447413	Subsoil, 24 to 44 inches.....	.3	4.2	13.0	28.2	13.1	10.4	30.9
447414	Subsoil, 44 to 48 inches.....	.0	5.0	12.8	27.5	12.5	8.4	33.7
447415	Subsoil, 48 to 140 inches.....	1.4	2.7	6.8	14.2	8.9	27.6	38.4

¹ After treatment with hydrogen peroxide.

KATY FINE SANDY LOAM

The surface soil of Katy fine sandy loam consists of a layer of fine sand or loamy fine sand from 14 to 20 inches deep. The color of the upper part, to a depth of 10 or 15 inches, is brown or grayish brown, and the lower part is gray or yellowish gray and distinctly lighter in color than the upper part. The material changes abruptly to the clay subsoil below, which consists of heavy mottled gray and red clay with an intermixture of a few yellow shades in many places. When wet, the clay is very dense and sticky, when moist it is somewhat crumbly, but when dry it becomes very hard and in exposed sections shows a natural breakage into nut-sized cubical fragments. At a depth ranging from 20 to 30 inches, the clay merges into lighter-gray fine sandy clay which contains less red mottles than the layer above. This layer has a larger fine sand content, which increases with depth, than the overlying material. At a depth of 5 or 6 feet the material, in places, is calcareous with lime-carbonate concretions. A few black concretions are also present throughout the subsoil in many places. To a depth ranging from 6 to 8 or more feet the material is clayey fine sand or fine sand.

This soil occurs in a number of small widely separated areas throughout the northern and central parts of the county. Most of the bodies lie within a few miles of Victoria and in the vicinity of the Donaldson Ranch. Katy fine sandy loam, in its surface layer, bears a marked resemblance to Hockley fine sandy loam, with which it is closely associated.

The relief is undulating, and drainage is very good. The land supports a very heavy growth of the coarse native prairie grasses which are practically identical with those growing on Hockley fine sandy loam. Practically none of the soil is in cultivation as it is included mostly in large ranch pastures and is utilized for grazing.

Katy fine sandy loam, gravelly subsurface phase.—To a depth ranging from 4 to 8 inches the surface soil of Katy fine sandy loam, gravelly subsurface phase, consists of grayish-brown or brown fine sand or loamy fine sand, which in the shallower areas has a red cast and generally contains a few small gravel. As a rule this layer grades rather abruptly into a bed of gravel, mainly cherty and quartzitic, of which from 20 to 40 per cent consists of fine, medium, and coarse sand in most places occupying the interstitial spaces between the gravel but in a few places occurring in thin bands between gravel layers. The gravel layer ranges from 8 to 28 inches in thickness. In many places a gravel layer of maximum thickness lies beneath the shallow surface soil. The gravel range in diameter from one-fourth to 1 inch, though in some beds considerable gravel 2 inches in diameter is found. The lower 2 inches of the gravel bed may be somewhat cemented by red clay. Beneath the gravel layer may be found a red heavy clay layer from 6 to 8 inches thick, a red and gray mottled heavy clay layer, or a red, gray, and yellow or yellowish-brown mottled heavy clay layer. The last-mentioned is the least common, and the first does not occur in many places, but where present it grades below into red and gray mottled clay.

This soil as mapped includes a small acreage in which the surface soil to a depth of 10 or 15 inches consists of grayish-brown or light-brown fine sand or loamy fine sand, containing enough small gravel, less than 1 inch in diameter, to constitute a gravelly fine sand. In some places a layer of gravel from 4 to 8 inches thick lies between the surface soil and the typical subsoil. In a few small areas of this phase a second layer of gravel ranging from 6 to 12 inches in thickness occurs below the red and gray mottled subsoil. Here the gravel is well mixed with the clay or sandy clay.

Areas of Katy fine sandy loam, gravelly subsurface phase, occupy the tops of knolls and ridges, the largest area occurring directly north of Victoria near Garcitas River. The gravelly material, as well as the surface soil and subsoil material, are derived from the Lissie formation.

The surface relief of the larger areas is mainly gently undulating, and the smaller areas are slightly hilly in places. Drainage ranges from fair to good or excessive in the more rolling areas, where erosion has removed considerable of the surface soil, leaving the gravel exposed in places. The heavy subsoil, however, restricts the downward and upward movement of moisture. On the more level areas, the gravel was found to be almost saturated with water for some time after heavy or continued rains.

The results of mechanical analyses of samples of the surface soil, the subsurface soil, and several layers of the subsoil of typical Katy fine sandy loam are given in Table 5.

TABLE 5.—*Mechanical analyses of Katy fine sandy loam*¹

No.	Description	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
		<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
447482	Surface soil, 0 to 15 inches.....	0.1	1.2	6.4	48.0	27.2	9.7	7.3
447483	Subsurface soil, 15 to 22 inches.....	.0	.6	3.5	29.2	18.7	10.7	37.2
447484	Subsoil, 22 to 30 inches.....	.2	.6	3.2	33.2	19.5	12.5	30.8
447485	Subsoil, 30 to 45 inches.....	.0	.0	2.8	31.6	25.3	14.1	26.2
447486	Subsoil, 45 to 62 inches.....	.0	.3	2.0	41.5	25.5	13.8	16.9
447487	Subsoil, 62 to 74 inches.....	.0	.2	1.6	46.5	25.3	11.8	14.6
447488	Subsoil, 74 to 146 inches.....	.3	.8	2.6	70.0	13.6	5.9	6.7

¹ After treatment with hydrogen peroxide.

SUSQUEHANNA FINE SANDY LOAM

The features of this soil are the same as those given in the series description of the Susquehanna soils (p. 21) and need not be repeated.

In the vicinity of Mission Valley a few areas contain more medium sand than is typical of the Susquehanna soils in Victoria County. Here the surface soil is light brown rather than grayish brown, and the upper part of the subsoil contains some yellow and yellowish-brown mottling. The yellow mottling was also noted in other particularly well-drained areas. In some places the upper few inches of the subsoil consists of red heavy clay which passes into the typical red and gray clay commonly underlying the surface soil.

Two outstanding features of this soil are the abrupt change from the fine sand surface soil to the heavy clay subsoil, and the accentuation of the red color of the subsoil when the material is moist. The extreme plasticity and stickiness of the subsoil in its typical development is also a feature of the soils of the Susquehanna series.

No reaction to hydrochloric acid is observed in the soil to the depth of the gray sandy clay containing white lime concretions or the caliche-like material, if these are present.

As mapped the soil includes small areas of DeWitt fine sandy loam, with which this soil is closely associated. Whereas DeWitt fine sandy loam occurs on the more gently undulating and slightly sloping areas, Susquehanna fine sandy loam occupies undulating areas and the steeper slopes where good drainage maintains. Owing to the more rolling relief, considerable erosion has taken place in some areas, much, if not all, of the soil material having been washed off in some places. Drainage is only fair, as the subsoil strongly resists the movement of moisture.

This soil does not occur in extensive areas. Most of it occupies the slopes from the upland level to the streams. The total area is 10.4 square miles, of which less than 10 per cent is under cultivation, the remainder being utilized for pastures.

In its virgin condition the soil is timbered with a rather open growth of post oak, some blackjack oak, and in some places a little live oak. The native grass growth consists mainly of the needle grasses (*Aristida*) and broom sedge (*Andropogon*).

Cotton, corn, the grain sorghums, and sorgo are the principal crops grown. Cotton yields from one-fifth to one-third bale to the acre, corn from 15 to 25 bushels, and the grain sorghums from 15 to 20 bushels or slightly more, the maximum yields being obtained in years of best moisture distribution.

Rains following cultivation or plowing have a tendency to cause the soil to compact and harden somewhat on drying. It is necessary to stir the soil soon after rains in order to maintain a pulverulent condition. The subsoil becomes very hard and compact when dry, but it assumes a state of high plasticity and stickiness on becoming saturated, after which it holds moisture for a long time. It prevents rapid downward passage of moisture, causing the soil immediately above the subsoil to become saturated. In rainy springs Susquehanna fine sandy loam remains colder for a longer time than the heavy soils of the coast prairie or the post-oak belt, but warms up earlier than the DeWitt and Edna soils. When the subsoil has once become saturated with moisture the soil can do without additional moisture for a considerable time, and only a moderate amount of additional moisture will mature most crops. Following dry periods, the soil in cultivated fields is inclined to drift during high winds, sometimes necessitating the replanting of crops.

Susquehanna fine sandy loam, gravelly subsurface phase.—The surface soil of the gravelly subsurface phase of Susquehanna fine sandy loam to a depth ranging from 3 to 6 inches consists of grayish-brown or brown very slightly loamy fine sand. In most places the color becomes somewhat lighter with depth, and usually a few small gravel are present. This material passes very abruptly into a bed of rounded gravel and fine and medium sand. From 40 to 90 per cent of the volume is gravel, ranging from one-fourth to 1 inch or more in diameter. The gravel bed usually ranges from 16 to 28 inches in thickness, and is of yellowish-brown or brown color and slightly compact when dry, but it has a distinctly red cast when moist, as has the moist surface soil. The gravel bed is abruptly underlain by an 8 or 10 inch layer of red and gray mottled heavy clay which is very plastic when wet and hard and compact when dry. The upper few inches of the subsoil may contain a few gravel. At a depth ranging from 4 to 5 feet is gray sandy clay, in places mottled slightly with red, yellowish brown, or brown. This material may contain thin strata of gravel, which extend to considerable depths. In some places the topmost 4 to 8 inches of the upper subsoil layer consists of red heavy clay which is extremely sticky and plastic when wet. In a few small areas the surface soil consists of gravelly fine sandy loam. No lime carbonate was found beneath this soil.

Soil of this phase occurs in the light-colored sandy soil section of the post-oak belt north and west of Nursery, in comparatively small areas on the tops of rounded mounds or ridges, most of which occupy the highest elevations in that section. This ridge and mound relief tends to give the soil good drainage, but drainage is hampered by the heavy character of the subsoil which becomes saturated with moisture, swells, and prevents the downward movement of the excess moisture. Following rainy periods many of the gravel beds are water-logged. Following dry seasons no moisture is present either in the subsoil or in the gravel layer, and the soil can not sup-

port crop growth owing to the shallowness of the surface soil. On areas having the steepest slopes most of the surface soil has been removed in places, giving the slopes the appearance of gravel beds.

None of the land was seen under cultivation. Because of its slight depth to gravel, the chief utilization of this land is as a source of material for road surfacing and railway ballast.

The results of mechanical analyses of samples of the surface soil, the subsurface soil, and several layers of the subsoil of typical Susquehanna fine sandy loam are shown in Table 6.

TABLE 6.—*Mechanical analyses of Susquehanna fine sandy loam*¹

No.	Description	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
		<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
4474183	Surface soil, 0 to 12 inches	5.3	13.4	22.4	33.2	12.1	8.5	5.0
4474184	Subsurface soil, 12 to 24 inches	2.5	9.2	16.2	19.5	6.0	9.0	37.6
4474185	Subsoil, 24 to 42 inches	2.3	9.3	20.0	31.0	8.4	7.1	22.1
4474186	Subsoil, 42 to 50 inches	2.2	10.0	19.9	27.1	7.7	9.2	23.7
4474187	Subsoil, 50 to 60 inches	1.4	11.1	30.8	22.2	3.7	11.0	19.7

¹ After treatment with hydrogen peroxide.

GOLIAD FINE SANDY LOAM

To a depth ranging from 6 to 10 inches the surface soil of Goliad fine sandy loam consists of dark-brown or nearly black fine sandy loam or very loamy fine sand, which in general grades through from 4 to 6 inches of dark-brown fine sandy clay loam into brown, reddish-brown, or in places dark-brown clay loam. At a depth ranging from 12 to 18 inches red or brick-red clay loam or clay, in most places clay, is reached, which continues to the underlying zone of lime-carbonate soil material. As a rule this zone occurs between depths of 20 and 40 inches. In some places overlying the lime-carbonate layer is a 2 to 6 inch layer of buff-brown or cream-colored clay loam or silty clay loam which is highly calcareous and contains many small concretions of soft white lime. Some lime concretions also occur in the lower 6 or 8 inches of the subsoil in the deeper areas, and this part of the subsoil also shows a reaction with hydrochloric acid, indicating the presence of soil lime carbonates. Neither the surface soil nor the upper part of the subsoil effervesce when hydrochloric acid is applied.

Goliad fine sandy loam is mapped in the northwestern part of the county, between Guadalupe River and Coletto Creek, in what is generally known as the Mission Valley country. (Pl. 2, A.) About 50 per cent of the land is under cultivation, and is highly prized for agricultural purposes. The areas, which are comparatively small, are associated with Goliad clay loam areas.

Drainage is good. On the more rolling cultivated areas the soil is subject to erosion.

At the present time all the uncultivated land of this kind is covered by a fairly dense or dense growth mainly of leguminous trees and shrubs.

This is considered a strong, productive soil. It holds moisture well under cultivation being somewhat superior to Goliad clay loam in this respect. When the surface soil dries out the cracks are rather narrow, but they extend into the subsoil to a depth ranging from 15 to 18 or

more inches. When dry the subsoil shows both vertical and horizontal cleavage lines, and many of the resultant clods are of roughly cubical shape and about an inch in diameter. The faces of many of the clods in the upper part of the subsoil are dark brown or black owing to the presence of dark-colored soil material which has been washed or fallen down through the fissures. Many old root channels and animal burrows are filled with dark-colored somewhat sandy material. On drying, the cultivated surface soil becomes granular or fine cloddy in structure. Efficient cultivation of this soil requires a medium or heavy equipment of draft animals and farm machinery. The soil is locally known as "black sandy land" or "black loamy soil."

The chief crops are cotton, corn, grain sorghums, and sorgo, the last-named being used for hay. Cotton yields from one-third to one-half bale to the acre when moisture distribution is favorable, and yields of three-fourths bale or more have been reported by some farmers in years of exceptionally favorable moisture conditions and minimum insect and other damage. Not much damage is caused by cotton root rot on this kind of soil, and boll-weevil damage is reduced to a minimum by early planting. Corn yields vary, in seasons of favorable moisture ranging from 25 to 35 bushels to the acre. The principal grain sorghums grown are Kafir and hegari, the last-named having lately become prominent.

When a supply of moisture falls in the middle of the season, two cuttings of sorgo are generally obtained. Ordinarily only one cutting of hay is made, and the second growth is utilized for pasturage.

Goliad fine sandy loam, shallow phase.—Soil of the shallow phase is similar to typical Goliad fine sandy loam in all respects except that all the upper layers are thinner. Consequently the layer with lime accumulation lies at a depth ranging from 12 to 18 inches rather than from 20 to 40 inches as in the typical fine sandy loam.

On the more severely eroded slopes the sandy surface layer may be entirely removed, and only a few inches of the dark-colored upper subsoil material overlies a shallow layer of the underlying red clay. In other places both surface soil and subsoil have been entirely removed leaving the lime layer exposed, and in still other places the lime layer has been exposed and later buried by a mixture of black or brown sandy material brought down from the higher-lying areas. Where the lime layer is exposed or is near the surface, the soil material, to a depth of a few inches, is generally hard, though the underlying material is soft and coarse floury in texture, the coarseness being caused by a high content of fine sand and very fine sand.

Areas of this shallow soil occur in rolling or hilly positions, and on the tops of knolls and ridges where an undulating relief prevails. Very little of the land is under cultivation. The farmed areas are adjacent to areas of typical Goliad fine sandy loam and other deeper soils. The shallowness of the soil is conducive to droughtiness, and its best utilization is as pasture land.

Goliad fine sandy loam, slope phase.—The slope phase of Goliad fine sandy loam differs from the typical soil only in mode of occurrence. The soil occupies sloping or rolling areas, and in most places the slopes are very steep. Drainage is very good, in fact almost too rapid, but as most of the soil is sandy to a considerable depth much of the water is taken up without rapid run-off. However, erosion is severe in places, but not so severe as to develop many gullies or badly washed

areas. Much of the land remains heavily sodded with the native prairie grasses, and doubtless this tends to retard erosion to a great extent.

Areas of the slope phase are scattered throughout many sections of the southern or "black land" part of the county, occurring in narrow strips bordering the larger stream valleys, mainly along Guadalupe and San Antonio River Valleys and some of their tributary valleys. One such narrow valley border strip passes through the southwestern part of Victoria stretching many miles along each side of Guadalupe River Valley.

Areas of this soil are treeless except for a few mesquite, live oak, hackberry, and anaqua trees. As a rule, the growth of native grasses is luxuriant.

Probably not more than 5 per cent of the land is in cultivation, much of it being included in the large ranches which are devoted to livestock raising. The cultivated areas are used for the production of the staple crops of the region. The deeper areas are well suited to the production of fruits and vegetables. Texturally the soil is almost ideal for many vegetables, and melons, cantaloupes, and other vine crops do well.

In Table 7, the results of mechanical analyses of samples of the surface soil, the subsurface soil, and several layers of the subsoil of typical Goliad fine sandy loam, are shown.

TABLE 7.—*Mechanical analyses of Goliad fine sandy loam*¹

No.	Description	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
		<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
4474174	Surface soil, 0 to 6 inches.....	0.4	6.3	11.2	31.6	21.4	15.8	13.3
4474175	Subsurface soil, 6 to 10 inches.....	2.0	8.5	10.7	28.8	14.5	16.0	19.4
4474176	Subsoil, 10 to 15 inches.....	2.8	6.1	7.8	21.8	17.0	16.3	28.2
4474177	Subsoil, 15 to 30 inches.....	3.2	6.3	7.1	16.2	14.3	18.7	34.2
4474178	Subsoil, 30 to 35 inches.....	2.5	4.1	5.2	12.4	10.4	24.3	41.1
4474179	Subsoil, 35 to 48 inches.....	2.8	5.4	7.6	15.5	7.4	36.7	24.6

¹ After treatment with hydrogen peroxide.

GOLIAD CLAY LOAM

To a depth ranging from 8 to 12 inches, the surface soil of Goliad clay loam consists of dark-brown or black clay loam which grades through about 4 inches of dark-brown or black heavy clay loam or clay into brown or reddish-brown clay. At a depth ranging from 15 to 20 inches the subsoil consists of dull-red, brick-red, or red clay which is semiplastic when wet and becomes very hard and compact when dry. The zone of soil lime-carbonate accumulation, a soft white chalk which is common under the Goliad soils, is present at a depth ranging from 18 to 36 or slightly more inches. Between this layer and the red subsoil there is in most places, but not everywhere, a layer of light-brown or buff-brown silty clay or clay loam, from 3 to 6 inches thick, which is highly calcareous. This layer is more apt to be present in places where the depth to caliche is greater. The surface soil and upper subsoil layers are not calcareous.

On the flatter areas the material becomes mottled with red, gray, and brown spots in the lower part of the red layer but the mottlings

disappear before the lime layer is reached at a depth ranging from 30 to 40 inches.

This soil is very sticky when wet, and on drying becomes rather hard. Subsequent exposure, however, causes the soil in cultivated areas to slake down into a small and fine cloddy condition. This slaking takes place even if the soil has been plowed when wet. When dry the subsoil cracks both horizontally and vertically. A large proportion of the resultant clods are cubical, about an inch in diameter. The faces of many of the clods are dark owing to the falling in of the dark-brown or black surface soil particles. Old root channels and animal burrows appear as black streaks in the red subsoil.

This soil occurs in the post-oak belt of the northwestern part of the county, between Guadalupe River and Coletto Creek. It occupies areas of smooth relief, the shallow phase being found in rolling areas. Drainage is fair or good but is somewhat restricted on the more level areas owing both to the relief and to the imperviousness of the subsoil. The upward and downward movement of soil moisture is said to be fair in spite of the heavy texture of the surface soil and subsoil material. Under cultivation the soil is said to conserve moisture well, but not so well as Goliad fine sandy loam.

About 50 per cent of the land is under cultivation, and it is considered a good, strong agricultural soil. The uncultivated areas are used for pasture land.

Most of the tree growth now found on this soil is said to have encroached on the original prairie within the last 50 years. There are some small prairie or semiprairie areas of soil. The vegetation consists mainly of the same trees, shrubs, and grass as grow on other Goliad soils.

This soil is locally referred to as "black heavy land." It is suited to the same crops as those grown on Goliad fine sandy loam, and, with favorable moisture distribution, crop yields are about the same or slightly higher than on that soil. The ordinary truck crops seem to do well. The soil is better suited to general farm crops than to vegetables.

Goliad clay loam, shallow phase.—This soil is essentially like Goliad clay loam in all respects except the thickness of the upper layers. The surface layer ranges from 5 to 8 inches in thickness and the second layer from 3 to 8 inches. The lime-carbonate layer beneath the red clay is reached at a depth ranging from 12 to 18 inches below the surface.

Immediately above the lime layer there may be 2 or 3 inches of brown mellow highly calcareous silty clay or clay loam. The lower part of the red clay subsoil may contain some small lime concretions and may show effervescence with hydrochloric acid.

On slopes where erosion has been more active than usual the lime layer may lie at the surface or the soil may be removed as far as the underlying red clay. Other borings show that both surface soil and subsoil have been entirely removed and only a black clay loam is present above the lime layer. This material has either washed over the caliche from higher-lying areas or has been weathered from the caliche since the removal of the original material. In those areas of the shallow phase between Mission Valley and Guadalupe River gravel occurs on the surface, also throughout the surface soil and subsoil of some areas.

The soil occupies slopes which are steep enough to have caused erosion of some of the surface soil.

The growth of trees, shrubs, and grasses on this shallow soil is very similar to that on Goliad clay loam. The land is used for pastures.

WILSON FINE SANDY LOAM

The surface soil of Wilson fine sandy loam consists of ash-gray or nearly black loamy fine sand or fine sandy loam from 6 to 15 inches thick. This layer passes rather abruptly into a dark-gray or black fine sandy clay loam or clay subsoil which extends to a depth ranging from 24 to 30 inches without change. No reaction is obtained on application of hydrochloric acid above this depth. Below the subsoil material is gray or brownish-gray highly calcareous clay which contains some semihard lime-carbonate concretions and some soft white floury lime aggregates. The marllike material may continue to a depth of 6 or more feet without change or it may grade into a cream-colored or buff highly calcareous clay in which there is considerable soft white limy material occurring in small rounded aggregates or in streaks and thin lenses.

This soil occurs in the semiprairies of the post-oak belt in the northwestern part of the county. Although the total area in Victoria County is very small, the bodies are undoubtedly the outliers of large areas of this soil to the north and southwest. This soil is different from any other soil occurring in this part of the county. It is associated with the DeWitt and Goliad soils, particularly with the sandy members of the Goliad series.

Most of the Wilson fine sandy loam areas occupy the flattened tops of small mounds and ridges. Some areas occur in more level positions where they are associated with the Goliad soils. The flatness of the surface and the heaviness of the subsoil material render both external and internal drainage only fair or poor, and the land remains saturated for long periods after heavy rains. The subsoil swells greatly on becoming saturated and it becomes very plastic. On drying it becomes very hard and cracks widely and deeply.

Probably not more than 25 per cent of the land is under cultivation, mainly to cotton, corn, and the grain sorghums. Cultivated fields present a spotted gray and black appearance, and are referred to as "mixed fields" or "mixed soils."

This soil does not occur in areas of sufficient size to constitute an entire farm. It is regarded as a fairly strong soil, the chief drawback being the lateness in drying out following a rainy spring or winter.

WILSON CLAY LOAM

The surface soil of Wilson clay loam consists of a layer, from 6 to 12 inches thick, of very dark-gray or black clay loam which grades into nearly black or black heavy clay loam or clay. This layer extends to a depth ranging from 18 to 24 inches and passes into dark-gray clay which is usually very tough, and which continues without change to a depth of 30 or 34 inches. In places it assumes a slightly brown tinge with depth. This layer is underlain by slightly dark-gray or gray very calcareous clay, in many places having a brown or yellow tinge and containing a few or numerous small semihard lime-carbonate concretions in the upper part and some soft white lime aggregates below. With depth the yellow color may increase until at a depth of

about 5 or 6 feet cream-colored and in some places buff clay occurs, which is marly, highly calcareous, and contains considerable soft white limy material, mainly in small aggregates, but to some extent in thin streaks and lenses. No effervescence is noted in the surface soil or upper part of the subsoil above the gray marly layer, though a few lime concretions are noted here and there in the lower part of the dark-gray subsoil.

This soil occurs in the northwestern part of the county, in the post-oak belt, in association with soils of the Goliad and DeWitt series. The total acreage is not large.

Virgin areas are covered with a growth of trees, shrubs, and grasses similar to those growing on Wilson fine sandy loam.

Probably 15 per cent of the land is under cultivation. The heaviest type of farm equipment is necessary to successfully utilize this soil for agricultural purposes. Owing to poor drainage the land can not be plowed until late in the spring, especially following a rainy winter season. Small ponds surrounded by mounds sometimes remain after the greater part of the land is sufficiently dry to allow cultural operations. However, this is considered a strong soil. It becomes droughty earlier than Wilson fine sandy loam and Goliad clay loam. Corn, cotton, grain sorghums, and sorgo (sweet sorghum) are the principal crops grown.

WILSON CLAY

To a depth ranging from 18 to 24 inches Wilson clay consists of black heavy clay. It grades into very dark-gray or dark-gray heavy clay which continues to a depth ranging from 32 to 36 inches. The material in this layer is generally calcareous in the lower part, and here also some semihard white lime concretions are present. Below this is gray or slightly dark-gray clay which becomes slightly lighter in color and acquires a yellow or brown tinge with depth, so that below a depth of about 4 or 5 feet brownish-gray or cream-colored clay is reached. This material extends beyond a depth of 6 feet and is highly calcareous and marly. Between depths of 3 and 4 feet, semihard lime concretions, ranging in quantity from few to numerous, also some white floury lime aggregates occur. The aggregates continue throughout the zone, increasing in size with depth, until at a depth of 6 feet, some of them are 1 inch in diameter. Streaks and seams of lime material are also noticeable in the lower part of the subsoil.

This soil occurs in small flat or nearly level interstream areas only in the northwestern part of the county, in the post-oak belt. The surface is of a hog-wallow character, due to minor surface inequalities. Owing to the very heavy character of the subsoil, the flatness of the surface, and the occurrence of mounds and hog-wallow depressions, drainage is very slow.

Practically none of the land is under cultivation. Virgin areas support a leguminous, thorny vegetation, locally known as chaparral, together with a few post-oak trees and short grasses of a subhumid type.

DEWITT FINE SANDY LOAM

The surface soil of DeWitt fine sandy loam consists of a 10 to 15 inch layer of brown or grayish-brown loamy fine sand or fine sand.

In areas in which the deeper soil prevails there is generally a layer from 1 to 3 inches thick of yellowish-gray or light-brown fine sand, which directly overlies the subsoil. The subsoil consists of yellow rather dense clay, generally mottled with gray, though there may be as much as a foot of the yellow clay which is without mottling or has only a fine mottling. The gray color increases with depth. Below a depth ranging from 30 to 40 inches the subsoil material consists of gray clay or sandy clay mottled with yellow, and below a depth of about 4 feet gray or light-gray sandy clay, in some places streaked, mottled, or splotched with yellow, is found. At a depth of about 6 feet there is in many places gray and yellow mottled clay or sandy clay which is calcareous in its reaction to hydrochloric acid and contains white carbonate of lime concretions. In areas lacking this layer, there is generally found at the same depth an alkaline soil layer containing whitish concretions (probably gypsum) which do not effervesce. The material above the alkaline layer is acid or strongly acid. Below a depth of 6 feet the material in most places is gray or light-gray sandy clay or very sandy clay, some of which is mottled, streaked, or splotched with yellow and some with red. In the lower part of the subsoil the red mottling or splotching generally occurs around black iron or manganese concretions. In a few areas, especially in the better-drained locations, the upper subsoil layer contains a small amount of red mottling, this being a gradation toward the Susquehanna soils, with which the soil is associated.

In several stream cuts, notably 7 miles northwest of Victoria, 2 miles east of Garcitas Ranch, and 3 miles southeast of Mission Valley, the profile of this soil showed, at a depth ranging from 6 to 15 feet, a highly calcareous layer consisting of white or cream-colored floury or slightly grainy material which was hardened on the exposed surface and soft beneath. These beds are from 3 to more than 6 feet in thickness. Those lying at the slighter depths showed tree roots extending through the layer which was underlain by gray sandy clay splotched with brown and ochereous yellow. Throughout the soft material, concretions of hard calcareous material ranging up to 1 inch in diameter and vertical seams of this hardened material, apparently along old root channels, were noted. Thin horizontal seams of the hardened calcareous material were also present. Although this may be accumulated material it should be remembered that it usually occurs close to calcareous parent materials of other soils.

In some locations, particularly in the north-central part of the county, layers of gravel and sand, seemingly assorted, were noted below a depth of 6 feet, and in a few places a solid bed of gravel occurs below a depth of 6 feet and continues to 10 feet, at which depth it rests on the caliche-like material described above. Where the caliche-like layer is present no effervescence with hydrochloric acid is noted above it.

The surface soil, in general, is very loose and is low in organic-matter content. The subsoil is rather dense and heavy, and when dry it becomes very hard and cracks deeply vertically, assuming a somewhat columnar structure. (Pl. 2, B.) Horizontal cracks also develop, giving rise to clods an inch or so in diameter, or roughly cubical in shape. When wet the subsoil is very sticky and plastic, and it swells considerably. Though deterring the free movement of moisture, when once saturated the soil holds moisture for a long time, giving it up

slowly, so that, under cultivation designed to keep down the weed growth and keep a soil mulch, this soil is fairly drought resistant, especially in the deeper areas.

DeWitt fine sandy loam occurs in that part of the post-oak belt occupied by light-colored soils and in tongues which extend southward from the main belt which lies along the north county line. Most of the strips border the uplands which lie along the major drainage ways. Fairly large areas are north of Inez near Arenoso Creek and west of Inez. Other good-sized areas occur on the uplands adjacent to the Guadalupe River bottoms and Coleta Creek.

The land is gently undulating. A large number of minor drainage ways pass through and many head in areas of this soil. Most of the land is well drained, though on the flatter areas, where the soil grades toward the Edna soils, drainage is slow, being hindered by the heaviness of the subsoil.

Virgin areas are covered with a tree growth consisting mainly of post oak, with a few blackjack oak and live oak.

The soil is used mainly for pastures. Less than 5 per cent of it is under cultivation principally to cotton, corn, the grain sorghums, and sorgo (sweet sorghum) for hay.

DeWitt fine sandy loam, gravelly subsurface phase.—The surface soil of this phase consists of a 2 to 4 inch layer of grayish-brown or brownish-gray loamy fine sand, passing into brown or light-brown loamy fine sand or fine sand which continues to a depth ranging from 8 to 15 inches. It is rather abruptly underlain by a layer of gravel containing considerable fine sand, medium sand, and fine gravel as interstitial material. The gravel consists mainly of quartz and chert and ranges, in general, up to about an inch in diameter, though some gravel 2 inches and larger in diameter are present. As a rule the gravel layer ranges from 4 to 15 inches in thickness. The subsoil material, beginning between depths of 15 and 20 inches or slightly deeper, consists of yellow or yellowish-brown dense rather heavy clay which in most places is mottled with gray and in some places with a small amount of red. Here and there the interstitial material of the gravel layer consists of the yellow and gray clay of the subsoil, especially in the lower part. The lower subsoil material is identical with that of typical DeWitt fine sandy loam.

This soil is developed on slopes in association with typical DeWitt fine sandy loam and in the same general region. The surface relief is similar, though drainage is somewhat better on account of the gravel layer. The total area in Victoria County is small.

None of the land was seen under cultivation. Areas in which the gravel occurs at greater depths would be suited to the same general crops as are grown on DeWitt fine sandy loam, and the same yields might be expected.

NORFOLK FINE SAND

The surface soil of Norfolk fine sand is gray or grayish-brown fine sand from 6 to 12 inches deep. It merges into pale-yellow or gray fine sand which is several feet deep. The subsoil rests at a depth of 5 feet or considerably deeper on heavier material ranging in texture from fine sandy clay to clayey fine sand of mixed or mottled gray, red, and yellow colors.

The soil is very light in color. It is loose when dry and only very slightly coherent when wet. Apparently this soil is very similar in most characteristics to Bienville fine sand, but as a rule, the surface soil is slightly lighter in color and the land occupies higher-lying upland positions.

Norfolk fine sand is of small extent in Victoria County. It occurs on the uplands, usually in association with other sandy soils. The largest areas are near the western edge of the county in the vicinity of and northwest of Raisin, and small areas are widely scattered over the county. As a rule the soil occurs on the uplands near stream valleys, suggesting an old accumulation by wind action or by water. The surface relief is undulating or billowy. Natural surface drainage is good, and water passes quickly down through the porous surface soil and subsoil. Miniature gopher mounds abound over the surface, and this soil seems to be preferred by these small burrowing animals.

Norfolk fine sand is not an important soil. The largest area supports a timber growth of live oak, post oak, blackjack oak, and a few pin oak and hickory trees. Many areas are semiprairie with but few trees. Here the legume Texas bluebonnet (*Lupinus subcarnosus*) covers the ground in places and seems to find its ideal habitat. Wild grapevines and small prickly-ash trees are common, and in places yaupon and French mulberry are found.

Practically none of the land is in cultivation but is used for pasture. The soil is too light for large production of general farm crops but is well suited to melons, peanuts, sweetpotatoes, berries, plums, grapes, and various other crops. Fertilization would probably be required to produce good yields after the land has been in cultivation a short time.

HARRIS CLAY

The surface soil of Harris clay consists of dark-gray waxy clay from 8 to 12 inches deep. It merges with little change into gray or bluish-gray very waxy clay which is several feet deep, though in places at a depth ranging from 3 to 4 feet it becomes light-gray fine sandy clay. In places thin seams of fine sand occur at various depths through the subsoil.

Typically the soil shows no lime carbonate by field test, though in most places in Victoria County the surface soil and upper subsoil layer are calcareous and effervesce with hydrochloric acid. This is owing to occasional overflows of fresh water from adjacent streams which carry limy material. The surface soil and subsoil also contain considerable sodium chloride which is indicated by the white film appearing over much of the dried surface soil.

Harris clay is very inextensive in the county. It occupies small marshlike areas in the extreme eastern part along the lower reaches of Garcitas River and Placedo Creek where coastal salt-marsh areas indent the broadened stream valleys and extend a few miles inland with practically no change in elevation but well marked by the presence of both salt-water and fresh-water marsh vegetation.

The areas are flat and poorly drained. The surface is only 2 or 3 feet above the streams and the waters of Lavaca Bay. In places ponds and spots of true marsh may occur, both salt and fresh water marshes. The salt-water marshes are covered with low salt-loving

plants and the fresh-water marshes with tall broad-leaved water plants, rushes, grasses, and salt-land plants. Now and then overflows of fresh water from the streams occur, and at infrequent intervals heavy winds from Lavaca Bay blow salt water over the surface. Much of the land is covered with water a considerable part of the year. The soil merges gradually inland and upstream into areas of alluvial soils, the change being marked by differences in natural vegetation.

This is not an agricultural soil and is used only for the scant grazing afforded by plants most of which are of low nutritive value.

TRINITY CLAY

The surface soil of Trinity clay consists of black or very dark-brown calcareous clay which merges at a depth ranging from 10 to 16 inches into gray, yellowish-gray, or brownish-gray calcareous clay many feet deep. In places the gray subsoil contains very small rust-brown spots.

The surface soil, though very plastic and sticky when wet, crumbles naturally into a mass of fine grains on drying. Under cultivation the surface soil is readily maintained in a deep loose friable mass.

Trinity clay is rather extensive in Victoria County. It occupies broad areas in the Guadalupe and San Antonio River bottoms, and is closely associated with Catalpa clay. In places these two soils merge so gradually that it is difficult to decide where a boundary line should be drawn.

The soil occurs mostly in low flat river-bottom areas, much of it in the lowest positions, especially in places where the uplands join alluvial lands. In some of the low places water stands for a considerable part of the year and the soil is in a semiswampy condition, but such areas are small and occur mainly along Coletto Creek. In some places in the southern part of the county, water stands over large bodies of the land during the greater part of the winter. Natural drainage is sufficient to allow cultivation of some large areas. All the land is overflowed from the swollen streams at times, and in the southern part of the county this is the first bottom land to be inundated. A few good-sized areas occupy slightly higher positions and really constitute very low second bottoms.

Most of the Trinity clay is timbered, though in the southern part of the county there are some good-sized prairie areas. Ash and elm predominate in the timbered sections, and the soil is often called "elm land." The prairie areas lie within the Traylor and McFaddin ranches, and on the McFaddin ranch the name "weed prairie" has been given the land. On these prairies a very thick tall growth of wolfweed (*Aster spinosus*) occurs, together with some clumps of button willow and small titi trees, and flags and rushes in the small wettest spots.

Probably not more than 20 per cent of the Trinity clay is in cultivation. It is considered a very strong, productive soil, but over much of it drainage is so poor that cultivation is unprofitable. Overflows in the southern part of the county occur with such frequency as to render crop production uncertain, and one planter reported that only about two crops in five years were obtained. In the better-drained

areas good crops are obtained every year, provided insect pests do not prevent. Cotton is the principal crop, and corn, sorgo, and grain sorghums are grown to some extent.

Trinity clay is a very strong soil and when properly drained will become one of the most valuable soils of the county. It is well suited to alfalfa, sweetclover, bur clover, Sudan grass, and other forage crops in the better-drained places. Pecans thrive only on the better-drained areas.

TRINITY FINE SANDY LOAM

The surface soil of Trinity fine sandy loam consists of dark-brown or brown loamy fine sand or fine sandy loam ranging from 12 to 20 inches in thickness. It passes into dark grayish-brown or slightly dark-brown fine sandy clay loam which at a depth of about 30 inches is underlain by slightly dark-brown or brown clay loam or silty clay. At a depth of about 42 inches is brown fine sandy clay loam or silty clay loam which becomes slightly lighter in color and slightly sandier in texture with depth. At a depth ranging from about 5 to 6 feet light-brown or yellowish-brown fine sandy loam or fine sandy clay loam is reached. Some snail shells occur in some places below a depth of about 2 feet. The soil is generally calcareous from the surface downward, as determined by the application of hydrochloric acid, but in some areas, especially in the lighter-colored areas, the topmost 8 to 12 inches does not react with acid.

Some variations from typical occur in this soil. These are chiefly the presence of thin strata of fine sand or very fine sand, below a depth of 3 feet as a rule, or a slight variation in the texture of the subsoil material, owing to the mixture of material deposited by the river.

The soil occurs in the Guadalupe River bottoms in the northwestern part of the county. Most of the land forms narrow rounded ridges resembling natural levees contiguous to the river and old channels, and thus occupies the highest valley positions. Its topographic position, as well as its openness, cause the soil to have good drainage, and the texture allows the soil to receive and store moisture for crop use. Under cultural methods that prevent excessive weed growth the soil conserves moisture well.

Only moderately heavy farm equipment is necessary in the cultivation of this land. The soil breaks down readily into an admirable tilth, breaking on exposure into a fine cloddy or single-grain structure. The land warms up early in spring, and cultural operations may begin before either Trinity fine sandy clay loam or Trinity clay are ready for cultivation.

It is said that less trouble is experienced with cotton root rot on Trinity fine sandy loam than on other members of the Trinity series, and since cotton can be planted early less trouble from insects prevails. Other crops grown, more or less successfully, are corn, grain sorghums, peanuts, alfalfa, sorgo, oats, and vetch.

This soil is highly prized as an agricultural soil, and its presence adds to the value of the farm. More than 75 per cent of the land is under cultivation at present. Virgin areas support a good fairly dense growth of pecan, elm, hackberry, and ash. Most of the uncultivated areas are adjacent to the river and occupy the steep or rolling

slopes down to the water level. Pecan trees are left as natural orchards in places by clearing off other timber growth, and excellent yields of nuts are obtained.

TRINITY FINE SANDY CLAY LOAM

To a depth ranging from 10 to 16 inches Trinity fine sandy clay loam consists of dark-brown, very dark-brown, or black fine sandy clay loam. This layer passes, generally through a dark grayish-brown light clay loam or clay loam layer, from 4 to 6 inches thick, into dark-brown heavy clay loam or clay, containing some snail-shell fragments, which extends to a depth of 30 or 36 inches. Below this layer and continuing to a depth of about 5 or 6 feet no important variation in texture takes place, but the color becomes gradually lighter, passing through dark brown into brown and light brown. At this depth yellowish-brown sandy clay or sandy clay loam is reached in most places. The profile of most areas below a depth of 2 feet showed snail-shell fragments. The soil and subsoil are highly calcareous as shown by effervescence with hydrochloric acid.

Some variations from typical occur. These consist chiefly in the depth to or the thickness of the different soil layers, and also in the few inclusions of thin layers of yellowish-brown sandy loam or loamy fine sand in the lower part of the soil profile. Some variation in the texture of the material beneath the surface soil was also observed, the fine sandy clay loam areas being underlain in some places by dark-brown heavy clay loam more than 3 feet thick. However, the soil is invariably calcareous from the surface down.

Though sticky when wet, the soil is comparatively friable when only slightly moist, and lends itself readily to agricultural operations when in this condition. The material crumbles readily into a fine cloddy structure. The soil retains and conserves moisture well under cultivation.

Areas of Trinity fine sandy clay loam occur in the first bottom of Guadalupe River, from Victoria northwest to the DeWitt County line. The areas lie slightly higher than Trinity clay areas, but the surface relief is nearly level. The narrower areas occupy slight ridges within Trinity clay areas. Drainage is fair in the larger areas and good in the narrower ridgelike areas. The land is subject to overflow during exceptionally high water stages, but a serious overflow from Guadalupe River had not occurred on this soil within five or six years prior to this survey.

Virgin areas of the soil were timbered, but nearly all the land is now under cultivation. Elm and ash are the dominant trees on the more poorly drained areas and hackberry and pecan grow in the better-drained places.

Trinity fine sandy clay loam is considered a strong and productive soil and has been so considered since the early history of this section of the country. Land of this kind was among that first cleared by the Jesuit Fathers along Guadalupe River in the northwestern part of the county in the early part of the eighteenth century, and on it they practiced agriculture under irrigation. Cotton, corn, sorgo, and the grain sorghums are the principal crops grown. Pecan trees, for nut production, are left in some of the cultivated fields.

CATALPA CLAY

The surface soil of Catalpa clay is very dark-brown, brown, or ash-brown calcareous clay or silty clay. It merges at a depth ranging from 10 to 15 inches into lighter-brown, yellowish-brown, or dark-gray calcareous clay which continues downward for many feet. In many places the subsoil below a depth of 24 inches is slightly lighter in texture than the surface soil being light silty clay or silty clay loam. Though the surface soil is heavy and sticky when wet the soil material in plowed fields crumbles down into fine grains on drying. Even when plowed in a moist condition causing large clods and lumps to form, the material breaks down readily on drying. In cultivated fields the surface soil to a depth of several inches consists of a shallow loose layer of fine-grained material in which the grains are so separated as to give the appearance and structure of a loam soil. In places the topmost 2 or 3 inches of the surface soil appear nearly black. In many places snail shells occur throughout the surface soil and subsoil.

Catalpa clay is a moderately extensive soil in Victoria County, occurring in the broad stream bottoms along Guadalupe and San Antonio Rivers, closely associated with soils of the Guadalupe and Trinity series. Some of the largest areas are south of Victoria. The areas having the slightly sandy lower subsoil layer occur mainly in the San Antonio River bottoms.

Catalpa clay occupies low flat bottom lands along the rivers. The land is nearly flat and some of it lies so low that surface drainage is very slow. The soil is subject to occasional inundations from overflows and at times this results in the ruin of crops, and subsequent plantings are too late for best development. Some bodies have sufficient natural surface drainage to enable rather early planting in dry seasons. Natural drainage is as a rule somewhat better than on Trinity clay.

A heavy timber growth of ash, elm, hackberry, and oaks abounds, together with some pecans in the well-drained areas.

A very large proportion of the land is in cultivation and some has been farmed for many years. The soil is very productive, and yields of all crops are good in seasons when poor drainage or insect pests do no great damage. Cotton is the principal crop, and small acreages are utilized for corn, grain sorghums, and sorgo. Excellent yields of sirup have been obtained from sugarcane grown on this soil. Some good native pecan orchards and some plantings of this tree are producing well. The soil is well suited to all the crops grown and is recommended for the production of alfalfa and clover where drainage is good. Sudan grass, sorgo, the grain sorghums, and vegetables could be more extensively grown.

As the soil is very strong and productive it will probably need no fertilization for many years. Its chief need is good drainage and protection from overflows by leveeing the streams.

GUADALUPE SILTY CLAY LOAM

The surface soil of Guadalupe silty clay loam is calcareous brown or light ash-brown silty clay loam, which on becoming thoroughly air-dry assumes a grayish-brown or light grayish-brown color. At a depth ranging from about 10 to 20 inches the soil merges downward into the calcareous gray or yellow fine sandy loam subsoil. In places the texture of the subsoil is fine sandy clay loam or loamy fine sand,

and in such places the subsoil extends downward to a depth of several feet and is underlain by heavy calcareous silty clay. In many places below a depth of 3 feet there are several alternating layers of soil materials ranging from fine sand to silty clay. In many places snail-shell fragments are abundant in the subsoil. The surface soil, when moist, is slightly sticky, but it dries out to a fine-granular condition, and even though clods form when the land is plowed wet or very dry these break down naturally into fine grains.

As mapped Guadalupe silty clay loam includes small unmappable areas of Guadalupe fine sandy loam. In places the soil merges gradually into other soils of the Guadalupe series, with which it is associated, and into adjacent areas of Catalpa clay and Trinity clay.

Guadalupe silty clay loam is moderately extensive. It occurs in many small areas and narrow strips along Guadalupe and San Antonio Rivers, as a rule occupying strips of land adjacent to the streams or old stream channels.

Areas of this soil, which are very smooth and nearly flat, occupy gentle swells and smooth ridges along the rivers and old stream channels that wind through the bottom lands. The highest parts are usually along the stream banks, and the land slopes gently away from the streams. This is a comparatively high-lying bottom-land soil, and though subject to overflow it is locally the last to become inundated. Surface drainage is fair, and this is one of the first of the bottom-land soils to dry out. Owing to the high sand content and the porosity of the subsoil, underdrainage is good. In the occasional periods of very dry weather crops on this soil suffer sooner than on Trinity clay and Catalpa clay, the principal adjacent bottom-land soils, but as a rule crops are more apt to suffer from too much rather than too little moisture.

Guadalupe silty clay loam is rather heavily timbered, and some trees of considerable size grow on it. Pecan trees appear to prefer this soil to other less well-drained soils. On account of the many buckeye trees growing on the soil in places, the local name of "buckeye land" has been given it. Elm, hackberry, and oak trees grow thickly, and there are many gum elastic and anaqua trees.

Probably not more than 50 per cent of the land is in cultivation. Although it is a valuable agricultural soil it occurs in narrow strips associated with more poorly drained soils and in many places it is not cultivated extensively. It is an alluvial soil, fairly well supplied with plant foods, is easily cultivated, and has sufficient natural drainage to enable it to be worked and planted early in the season, provided there are no overflows.

The principal crops grown are cotton and corn, with smaller amounts of sorgo and grain sorghums. In a few places small plantings of vegetables, berries, pears, plums, figs, and sugarcane indicate that the soil is well suited to these crops.

No special methods are in general use for the improvement of this soil. It is naturally productive and even where crops have been grown for many years the yields remain good. Probably if a supply of humus is kept in the soil by plowing under organic matter the soil will not require fertilization for general farm crops for a long time. The soil seems to be especially suited to pecans, and many trees and groves have been left growing in their native stands even within

cultivated fields. (Pl. 2, C.) The soil is also well suited to alfalfa, sweetclover, and some other clovers. Fields of this soil near Victoria, said to have been in cultivation nearly 100 years, are still producing excellent crop yields.

GUADALUPE CLAY

The surface soil of Guadalupe clay consists of brown or very dark-brown calcareous silty clay which on drying becomes ash brown or light ash brown in color. At a depth ranging from 8 to 15 inches the material merges into brown calcareous silty clay which is somewhat lighter in color than the surface soil and contains fragments of snail shells. This layer, in turn, is underlain by yellow or gray calcareous silty clay loam, silt loam, or heavy fine sandy loam at a depth ranging from 18 to 30 inches. The lighter-textured material extends downward several feet passing, in places, through merged layers of various textures, usually lighter than clay, and rests on tight brittle heavy calcareous silty clay which is many feet thick.

Though heavy and sticky when wet the soil is crumbly when moist, and on drying in plowed fields it breaks down naturally into a mass of coarse grains. No difficulty is experienced in working the surface soil into a very friable consistence.

Guadalupe clay is inextensive. Several fair-sized areas are in the vicinity of McFaddin in the San Antonio River bottom. The soil is very similar in surface appearance to Guadalupe silty clay loam with which it is associated. However, it is somewhat more difficult to cultivate, owing to its heavier texture and less advantageous drainage position. The surface soil closely resembles that of Catalpa clay which it usually joins.

Guadalupe clay occupies slight ridges and swells in the river bottoms along streams. It slopes gently away from the stream banks merging into areas of Catalpa clay and Trinity clay in the lower-lying positions. Although overflowed at times, the soil dries out more quickly than the lower-lying Trinity and Catalpa soils. Owing to the fairly porous character of the lower part of the subsoil, underdrainage is good.

This is a timbered soil, the same trees growing on it as on Guadalupe silty clay loam.

Probably 50 per cent of the land is in cultivation. The largest body farmed is in the southern part of the county on the McFaddin Ranch in the San Antonio River bottom. This is a very strong and productive soil and is highly esteemed. It is utilized largely for cotton, though considerable corn, sorgo, and grain sorghums are grown. In good seasons when undamaged by pests cotton yields 1 bale or more to the acre, but the average yield is considerably less. Corn yields well, producing as high as 60 bushels to the acre. Sorgo and hegari produce good yields of seed and forage. Sudan grass and other forage crops make a splendid growth and high yield. The small acreage in alfalfa produced an average of 1 ton of hay to the acre at each cutting from five cuttings a year. Some sugarcane has been grown successfully. In places some fine native pecan trees produce excellent yields of nuts.

Guadalupe clay seems to be such a productive soil that no special fertilization will be necessary for a long time. However, care should be taken to keep a good supply of humus in the soil by plowing under organic matter.

GUADALUPE FINE SANDY LOAM

Guadalupe fine sandy loam is brown calcareous fine sandy loam or loamy fine sand to a depth ranging from 6 to 15 inches, at which depth it merges into light-brown calcareous loamy fine sand which continues downward to a depth of several feet. As a rule the subsoil is somewhat lighter in texture than the surface soil. The soil is rather loose and friable and is very easily cultivated.

This is very inextensive soil. It occurs in small areas along stream banks in the Garcitas, Guadalupe, and San Antonio River bottoms, and along Arenoso and Coleto Creeks in close association with Guadalupe silty clay loam, the largest area lying south of Victoria along Coleto Creek.

Guadalupe fine sandy loam occupies the highest parts of the slight swells or ridges of the stream bottoms, and, as a rule, surface drainage and underdrainage are good. The land is sometimes overflowed though not so frequently or so deeply as most of the other bottom-land soils.

The native timber growth includes about the same varieties of trees as on Guadalupe silty clay loam. The soil is locally known as "buckeye land" or "sandy buckeye land." Anaqua trees are abundant, and many pecan trees grow in places.

Probably not more than 50 per cent of the land is in cultivation. It is farmed in conjunction with associated soils of the same series. The same crops are grown as on the silty clay loam member, but yields as a rule are somewhat lower. The soil is rather light in most places, and in extremely dry seasons crops suffer on this soil sooner than on the heavier soils. The soil under intensive cultivation will probably require nitrogenous and phosphatic replacements, and care should be taken to maintain a good supply of humus by plowing under organic matter.

BIENVILLE FINE SAND

The surface soil of Bienville fine sand consists of brown, light grayish-brown, or dark-gray loose fine sand, which merges at a depth ranging from 4 to 8 inches into pale-yellow or grayish-yellow loose fine sand. At a depth of 4 feet or more the sand rests on friable red or yellow fine sandy clay, containing, in most places, considerable gray mottles, the gray color being especially marked a few inches below the topmost part of the clay layer. The surface soil and subsoil are both very loose and incoherent, and areas on which vegetation is absent or scant are subject to drifting in high winds.

Neither surface soil nor subsoil is calcareous, but in some places a yellow calcareous sandy clay or fine sand containing lime-carbonate concretions is reached at a depth of 5 or 6 feet below the surface. Doubtless the material rests on gravel or fine sand beds at a depth of several feet.

Bienville fine sand is not extensive in Victoria County. It occupies comparatively small marginal upland areas near the stream bottoms. The larger bodies border the lowlands of Guadalupe River, and smaller bodies lie near some of the other streams. Some typical areas lie 6 or 7 miles southeast of Victoria in the vicinity of Crescent Valley School.

The areas occupy the higher parts of nearly flat terraces from 5 to 20 or more feet above the adjacent first bottoms of the streams. The soil occurs in association with Bell clay and Milam fine sandy loam. The surface is gently undulating or billowy, in some places having a slightly dunelike configuration.

Surface drainage and underdrainage are very good, as the water sinks downward quickly through the porous surface soil and subsoil. This soil appeared to be preferred as the habitat of the small burrowing animals, known as gophers, as evidenced by numerous miniature sand mounds dotted over the surface.

This is an agriculturally unimportant soil. Owing to the thinness of the surface soil and its low productiveness for general farm crops, very little of the land has ever been cultivated and it is much less valuable for farm crops than the surrounding soils. Much of it is comparatively open prairie, but in places open parklike growths of live oak trees attain immense size. Only very moderate yields of cotton, corn, and sorgho have been obtained. The soil appears well suited to watermelons and other vine crops, grapes, berries, and plums. When clear of vegetation, the soil blows and drifts badly in the strong spring winds. It seems to be deficient in organic matter, and judging from soils of similar characteristics it is somewhat deficient in nitrogen and phosphorus.

MILAM FINE SANDY LOAM

The surface soil of Milam fine sandy loam is brown, light grayish-brown, or very dark-brown loamy fine sand from 14 to 20 inches deep, the lower part in places being fine sandy loam. The surface soil grades rather abruptly into dark-red or dull-red rather heavy but crumbly fine sandy clay which with increasing depth becomes lighter in color and more sandy in texture. This material passes very gradually, at a depth ranging from about 24 to 36 inches, into yellowish-red or reddish-yellow fine sandy clay, which with depth contains an increasingly high proportion of fine sand, and at a depth ranging from 4 to 5 feet is yellow fine sand, in some places calcareous. In places this sand rests on beds of rounded chert and quartz gravel which in one place examined was cemented with lime carbonate into a conglomerate, but in other places the fine sand and gravel beds showed no lime carbonate when tested with hydrochloric acid. The surface soil and subsoil show no reaction when tested for lime carbonate. In a few places the gravel bed lies within 3 or 4 feet of the surface.

The surface soil is very friable and loose, being only slightly coherent when wet. The subsoil is heavy and hard in an air-dry condition but crumbly when moist. Low round small sand mounds occur in places on the surface.

Milam fine sandy loam is very inextensive. It occurs in very small areas on some of the flats bordering Guadalupe and San Antonio Rivers. Small areas are near Victoria and southeast of Victoria near Crescent Valley School. The soil is usually associated with soils of the Bell series.

The areas are undulating, and drainage is good. The soil lies slightly higher than the Bell soils. The most typical areas are on or near the gentle slopes of the outer terrace margins adjoining the first-bottom soils.

Small areas of Leaf fine sandy loam, which have a gray and red mottled subsoil, too inextensive to map separately, are included with mapped areas of Milam fine sandy loam.

Milam fine sandy loam is considered a rather strong and fairly productive soil. Probably 50 per cent of the land is in cultivation on farms composed mainly of more extensive soils. The virgin soil is covered with a heavy growth of the coarser prairie grasses and in places supports a few live oak, mesquite, and huisache trees.

The soil in cultivation is used for the regular farm crops of the region, cotton, corn, sorgo, and some grain sorghum. In favorable seasons cotton yields from about one-fourth to one-half bale to the acre and corn from 15 to 20 bushels. The soil is well suited to vegetables, berries, and such fruits as plums, peaches, and pears. Some market gardening is carried on with good results in the vicinity of Victoria.

The soil requires a good supply of organic matter for best results and this should be maintained under any system of farming employed. It responds to applications of barnyard manure, and, doubtless, applications of commercial fertilizers containing nitrogen and phosphoric acid would increase the yields of many crops.

In Table 8 are given the results of mechanical analyses of samples of the surface soil, the subsurface soil, and three layers of the subsoil of Milam fine sandy loam.

TABLE 8.—*Mechanical analyses of Milam fine sandy loam*¹

No.	Description	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
		<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
447470	Surface soil, 0 to 14 inches.....	0.5	8.0	25.3	45.2	9.1	6.2	5.6
447471	Subsurface soil, 14 to 24 inches.....	.1	2.0	11.5	28.3	9.8	7.8	40.6
447472	Subsoil, 24 to 36 inches.....	.1	2.0	14.0	33.8	11.1	10.9	28.1
447473	Subsoil, 36 to 50 inches.....	.1	2.7	21.6	41.5	10.1	7.2	16.8
447474	Subsoil, 50 to 60 inches.....	.2	7.2	32.0	41.1	6.9	4.1	8.7

¹ After treatment with hydrogen peroxide.

BELL CLAY

The surface soil of Bell clay is black, very dark-gray, or very dark-brown calcareous clay which merges at a depth ranging from 10 to 15 inches into dark-gray or dark-brown calcareous clay differing very little from the surface soil except in its slightly lighter color. At a depth ranging from 24 to 48 inches this layer, in turn, merges through a transitional layer of gray or yellowish-gray soft calcareous clay, containing lime-carbonate concretions, into yellow or cream-colored soft friable clay marl containing white floury lumps and hard concretions of lime carbonate. The marl becomes increasingly sandy with depth and rests, at a depth ranging from several feet to as much as 20 feet, on beds of rounded chert and quartz gravel.

In virgin areas Bell clay bakes very hard on drying, and vertical cracks extend downward. The surface in places becomes pitted with hog wallows. In cultivated fields the soil works readily into a mass of fine grains. When broken with plows large clods are formed, but, on drying after rains, these break apart naturally or are readily crushed with tillage implements.

Field tests of some included areas show no lime carbonate in the surface soil or subsoil to a depth ranging from 3 to 4 feet, or nearly to the marl zone. In such areas the soil resembles Lake Charles clay in most characteristics.

Bell clay is of slight extent in Victoria County. It occurs in a number of small areas through the central and southern parts adjacent to the Guadalupe River and San Antonio River bottoms. One of the larger and most typical bodies lies about 2 miles southwest of Victoria, and others are southeast of Victoria near Crescent Valley School.

The soil occupies smooth nearly flat areas in terrace or second-bottom positions bordering the first-bottom alluvial flood plains of the rivers. The surface is flat or slightly undulating and in places is slightly depressed. Drainage is generally good, though in some places water stands for a while. A few areas are covered with water for a short time during unusually high overflows, but many years may elapse between inundations. Most of the land lies from 10 to 30 feet above the first bottoms.

This soil, locally called "black land," is highly esteemed by farmers. Probably 90 per cent or more is in cultivation, principally to cotton, corn, and forage crops. Originally it was prairie land with a heavy growth of native grasses, mainly of coarse varieties. A few trees and shrubs grow in places.

Bell clay is considered a very desirable soil as is evidenced by the large proportion in cultivation. It is highly productive and can be worked readily into a friable easily cultivated soil. Though very sticky when wet, the soil may be readily cultivated when moist and with tillage forms a friable seed bed that is easily worked throughout the hot dry weather. No commercial fertilizers have been used, and doubtless if a good supply of organic matter is maintained in the soil it will not suffer rapid depletion. It is reported that some fields which have been in cultivation for more than 40 years, appear about as productive as land that has been in cultivation a much shorter time.

Owing to its slight extent the land has no separate sale value as a rule. It is well suited to the crops commonly grown and also to alfalfa, sweetclover, bur clover, and to some vegetables. Sudan grass would produce excellent yields.

COLETO FINE SAND

The surface soil of Coletto fine sand is brownish-gray or light-gray fine sand which in places merges at a depth ranging from 6 to 10 inches into pale-yellow fine sand continuing for many feet, but in other places the gray color prevails from the surface to a depth of many feet. The soil is very loose and incoherent in most places and typically shows no lime carbonate by field test. However, in other areas, which are so low as to receive overflow water, the lower-lying soil is very slightly loamy and contains a small amount of lime carbonate. A small amount of lime carbonate is present in some of the higher-lying areas. This is probably owing to dust blown from adjacent calcareous soils.

This is an inextensive soil. It occurs in many small narrow areas along the streams in the narrow bottoms along Coletto, Arenoso, and other creeks and along the lower reaches of Garcitas River.

Areas of Coletto fine sand are undulating or billowy, in many places a dunelike configuration suggesting a wind-blown origin. The soil

occurs in narrow strips and small areas in creek bottoms in close association with, but lying higher than, Bienville fine sand. Most of the soil occurs close to or along the stream bank, and on the smaller streams the bodies may be not more than 100 or 200 feet wide. The remainder of the bottom is occupied by Bienville fine sand. The land is overflowed only occasionally. Surface drainage and underdrainage are good, owing to the looseness and porosity of both surface soil and subsoil.

Coleto fine sand is a thin, loose soil of rather low productiveness in most places, and practically none of the land is cultivated. It supports a rather open timber growth of live oak, together with various shrubs and coarse plants and a sparse growth of coarse grasses.

The soil is too light and thin for use in growing the general farm crops. Probably fair yields of melons and some of the vine crops could be grown. Much of the soil would doubtless be subject to blowing and drifting where unprotected by vegetation. It is of practically no agricultural importance.

JOHNSTON FINE SANDY LOAM

Johnston fine sandy loam consists of a very dark-gray, dark-brown or black fine sandy loam or loamy fine sand ranging from 15 to 60 or more inches in depth. Generally, however, at depths of 24 inches or less there is present dark-brown or black clay or clay loam, which extends to a depth of more than 5 feet. Effervescence with hydrochloric acid is noted in the material in few places above 5 feet.

Local variations in the profile of this soil consist chiefly in the occurrence of gray clay loam or clay mottled with brown or yellowish brown and in some places with rust brown at a depth ranging from 24 to 60 inches. In some small areas this material lies directly beneath the surface soil, but in most places the typical subsoil of dark-brown or black clay occurs between the surface soil and the gray clay. The gray clay does not react to hydrochloric acid.

Other variations from the typical soil may include a thin layer of brown or grayish-brown fine sand over the dark-colored surface soil, caused by wash from adjacent higher-lying areas of DeWitt fine sandy loam. Strata of this lighter-colored material may also be found throughout the soil. Small areas of Bienville fine sand may also be included.

Johnston fine sandy loam is mapped along the first bottoms of a few streams which traverse the section of dark-colored soils of the post-oak belt in the northwestern part of the county. It occurs in narrow strips adjacent to the streams and is subject to overflow. Less than 5 per cent of the land is under cultivation.

In general, drainage is good. The moisture-holding capacity of the soil is generally good, and it is very good in the deeper soil areas, especially where the weed growth is kept down and a mulched surface provided in order to reduce moisture evaporation to a minimum.

This soil responds readily to cultural practices, and a good seed bed can be easily attained, especially when the soil is slightly moist, in which condition it breaks down to a fine tilth. If cultivated when too wet the soil has a tendency to clod but the clods are easily broken down by light cultivation. The soil has a slight tendency to slake down to a fine cloddy structure, but this is not so pronounced as in the calcareous Trinity soils.

Corn and cotton comprise the chief cultivated crops, and both do well, though in wet years weeds sometimes crowd out the crops. Crops are planted rather late in order to avoid damage from overflow. Land not under cultivation is utilized for pasture. The timber growth consists mainly of post oak, with some live oak, ash, and hackberry.

JOHNSTON CLAY LOAM

Johnston clay loam consists of very dark-gray, dark-brown, or black clay loam which extends to a depth ranging from 8 to 60 or more inches without much change. The material is somewhat more compact in the lower part than in the upper part of the layer. As a rule, however, at a depth ranging from 8 to 24 inches, the soil is underlain by black clay which is generally very compact, is sticky and plastic when wet, and hard and compact when dry. At a depth ranging from 24 to 40 inches the black clay gives way to dark-brown clay or clay loam which has a more favorable structure than the layer above. With depth, the material becomes gradually lighter in color and in some places, in texture. In a few places at a depth of 60 inches is light-brown fine sandy clay loam or sandy clay. Thin layers of gray or light-brown fine sand occur in some bodies of this soil. To a depth of 5 feet the soil in very few places reacts to hydrochloric acid.

In some places the surface soil is underlain at a depth ranging from 24 to 40 inches by gray or slightly dark-gray clay or clay loam, mottled with brown or rust brown. This material may directly underlie the dark-colored soil material, or there may be a layer of black heavy clay between the surface soil and the gray substratum. The material of the substratum is probably the same as the parent soil material under the DeWitt and Susquehanna soils on the upland. It does not effervesce with application of hydrochloric acid.

The soil occurs in small, generally very narrow, areas along some of the larger creeks flowing through the dark-colored soil area of the post-oak belt in the northwestern part of the county. It occupies first-bottom positions, and is subject to overflow. The soil material is derived from the dark-colored upland soils along the upper courses of the streams.

Areas of Johnston clay loam are, in general, nearly flat, and drainage is only fair. Subdrainage is restricted by the heavy subsoil material, which when wet swells and becomes very compact, sticky, and plastic, and once saturated holds moisture for a long time. The poor drainage is accentuated by the low position in the bottoms on which the soil occurs.

The total extent of this soil in Victoria County is small, and probably more than 90 per cent remains in its virgin timbered condition and is utilized for pasture land. The tree growth consists mainly of post oak, ash, and hackberry, with here and there a live oak.

Cotton, corn, and the grain sorghums are the principal crops grown. Too much moisture during the preplanting season causes the crops to be planted late, and weeds have a tendency to choke out the crops. Heavy implements and work animals are required to properly prepare this soil, though once plowed and then worked under slightly moist conditions it breaks down fairly readily into a small cloddy structure. If plowed when too wet or too dry it breaks up into large clods which become very hard. The soil has a tendency to slake down on exposure to weather, but not so much as the calcareous Trinity soils.

On farms including sufficiently large areas of this soil to be cultivable, the value of the farm is enhanced.

ROUGH BROKEN LAND

This separation represents a soil condition rather than a soil type. The material includes soil on the steep slopes extending from the western upland level to the bottoms of Guadalupe River southwest of Nursery. Here the difference in elevation between the upland and bottom ranges from approximately 75 to 100 feet. The slope is more abrupt here than in most places owing to the fact that the caliche which underlies the upland Goliad soils has been exposed and has become indurated, protecting the upper part of the slope from further washing. However, small streams have worked their way through the caliche layer, and this feature, together with the steep slopes, gives a rough broken appearance to the rise from the bottom to the level of the upland. Here and there huge fragments of caliche have been broken off and deposited on the lower slopes. The part of the slope which is least rough is generally timbered. In places where the indurated and semi-indurated caliche is exposed there is usually only a sparse grass growth.

The less precipitous slopes occupying areas where the slope from the upland to the river bottoms is less abrupt are included in the slope phase of Lake Charles clay loam and the shallow phases of Goliad fine sandy loam and Goliad clay loam. The soil material on the slopes of rough broken land is very similar to the soils mentioned.

The timber and grass growth are similar to those on the Goliad soils. The only value of this land is for pasture.

The total area of rough broken land in Victoria County is small.

SUMMARY

Victoria County is in south-central Texas in the Gulf coast region. Its total area is 890 square miles, or 569,600 acres.

The land over the greater part of the county is flat, and in the northern part includes undulating and rolling areas. Very few areas are steeply sloping. A broad strip of bottom land, comprising the flood plain of Guadalupe River, crosses the central part of the county from north to south. A similar bottom lies along San Antonio River on the southern border. The elevation of the county ranges from about sea level in the eastern part to nearly 300 feet in the northwestern part. The general slope of the land is from northwest to southeast.

Drainage is very poor over large areas, surface water being carried from the land by a few small intermittent creeks and branches. The northeastern half of the county drains into Lavaca Bay through several streams, the principal ones being Garcitas River, Arenoso Creek, and Placedo Creek; and the southwestern half is drained by Guadalupe River, San Antonio River, and Coletto Creek. These streams receive local drainage from a very few small streams. Much land is artificially drained.

Abundant and good drinking water is obtained from shallow wells throughout the county, and many artesian wells are located in the southern part.

In 1930 the population of the county was 20,048 of which 63 per cent was classed as rural. Victoria, the county seat and principal town, with a population of 7,421, has been an important business and ranching center for more than 100 years.

Lines of two important railroad systems traverse the county, affording good transportation facilities. Most roads are of dirt construction, but some are good graveled roads.

The climate is healthful and mild. The mean annual temperature recorded at Victoria is 70.6° F. The mean annual precipitation of 35.71 inches is well distributed throughout the frost-free season which averages 281 days. Damaging droughts are rare.

The principal occupations are livestock raising and general farming. The farm crops comprise cotton as a cash crop, corn, grain sorghums, sorgo, and Sudan grass. Cotton ranks first in acreage and corn second. The grains and forage are consumed on the farms of the county. Though the climate and soils are well suited to vegetable growing, at present this industry is local. Fruits do fairly well if the orchards are well cared for. Citrus fruits grow well and return good yields, when not damaged by occasional freezes. Alfalfa, bur clover, and sweetclover thrive on certain soils, though they are grown very little at present. Pecans reach their best natural development on the better-drained bottom lands. Grapes and berries thrive.

Little dairying is done, though on account of the mild climate and high yield of forage crops there is considerable interest in the further development of this industry. The farms and ranches are as a rule well improved with good buildings and livestock.

No systematic crop rotation is practiced, though many farmers change their crops from time to time. Many, however, plant cotton on the same land for many years in succession. Very little commercial fertilizer is used, and results from its use are as yet uncertain.

The chief farming problems are drainage and insect pests, and in places the improvement of soil fertility is also important. Plant diseases cause some damage. A large proportion of the land is farmed by share renters and croppers, the last-mentioned being usually under the general supervision of the owners. A rather large proportion of renters and croppers are Mexicans. Farm labor is sometimes scarce and expensive at the busiest season, especially at cotton picking time. The price of farm land ranges from about \$25 to \$100 an acre. Most of the farms range from 100 to 200 acres in size, and many large individual holdings ranging from 300 to 3,000 acres are in cultivation. The cattle ranches range from a few thousand to 30,000 acres.

Victoria County lies almost entirely within the Gulf coast prairie. The geologic formations from which the soils have developed include unconsolidated water-laid marine deposits of sand, clay, and gravel belonging mainly to the Quaternary system. They are (1) recent Quaternary which comprises the very recent sediments in stream bottoms; (2) the Beaumont clays which underlie the dark soil belt of the coastward part of the coast prairie; (3) the upper Lissie clays and sand which underlie the light-colored soil belt just north of the dark soil belt; (4) the lower Lissie sands, gravels, and clays which comprise the northern part of the county, and (5) very small exposures of the Reynosa (Tertiary) calcareous clays in the northwestern part of the county. These belts cross the county in approximately an east-west direction. The soils developed from these formations

are characterized by mature profiles showing a definite relationship to parent materials and to the influence of a mild, warm, moderately moist climate acting on the materials under extremes of moisture conditions. The flat surface and consequent poor drainage in many places causes a saturated condition for several months during the winter. Excessive evaporation and a dense vegetative cover cause the soils to become very dry during the long summer.

The soils of the county lie in two broad groups, the humid soils which are acid in reaction and the subhumid soils in which lime carbonate has been segregated in beds below the surface.

The soils of Victoria County have been grouped in 18 soil series represented by 30 soil types and 10 phases of types. Rough broken land occupies a small acreage.

The Lake Charles soils cover most of the southern half of the county. They are very strong and productive and are the most extensively farmed soils. Other soils devoted mainly to general farming are members of the Goliad, Guadalupe, Milam, and Bell series. A large proportion of the land is covered with a virgin growth of timber or native grasses and is used principally as pasture land. However, if adequate drainage were provided, much of this would become valuable agricultural land.

[PUBLIC RESOLUTION—No. 9]

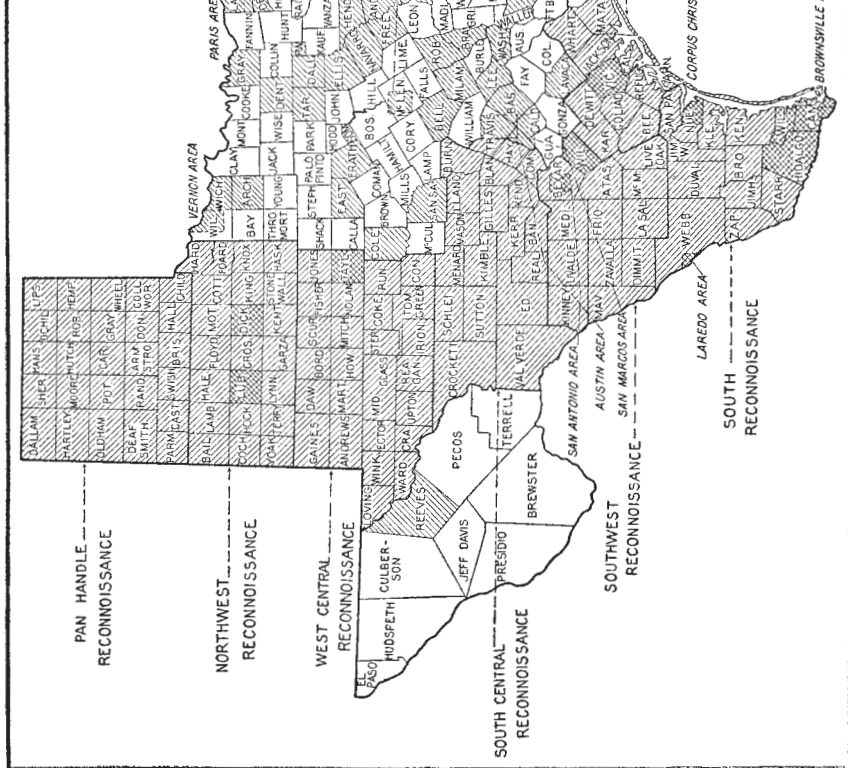
JOINT RESOLUTION Amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture."

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, be amended by striking out all after the resolving clause and inserting in lieu thereof the following:

That there shall be printed ten thousand five hundred copies of the report on field operations of the Division of Soils, Department of Agriculture, of which one thousand five hundred copies shall be for the use of the Senate, three thousand copies for the use of the House of Representatives, and six thousand copies for the use of the Department of Agriculture: *Provided*, That in addition to the number of copies above provided for there shall be printed, as soon as the manuscript can be prepared, with the necessary maps and illustrations to accompany it, a report on each area surveyed, in the form of advance sheets, bound in paper covers, of which five hundred copies shall be for the use of each Senator from the State, two thousand copies for the use of each Representative for the congressional district or districts in which the survey is made, and one thousand copies for the use of the Department of Agriculture.

Approved, March 14, 1904.

[On July 1, 1901, the Division of Soils was reorganized as the Bureau of Soils, and on July 1, 1927, the Bureau of Soils became a unit of the Bureau of Chemistry and Soils.]



Areas surveyed in Texas, shown by shading

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